Nexus® 1262/1272

High Performance Utility Billing Meters

Installation & Operation Manual

V.1.15

January 9, 2013

Electro Industries/GaugeTech

The Leader In Power Monitoring and Smart Grid Solutions

1800 Shames Drive, Westbury, NY 11590 Tel: (516) 334-0870 Fax: (516) 338-4741 Email: sales@electroind.com

www.electroind.com

This page intentionally left blank.

Nexus® 1262/1272 Meter Installation and Operation Manual Version 1.15

Published by:

Electro Industries/GaugeTech

1800 Shames Drive

Westbury, NY 11590

All rights reserved. No part of this publication may be reproduced or transmitted in any form or by any means, electronic or mechanical, including photocopying, recording, or information storage or retrieval systems or any future forms of duplication, for any purpose other than the purchaser's use, without the expressed written permission of Electro Industries/GaugeTech.

© 2013 Electro Industries/GaugeTech

Nexus® and Shark® are registered trademarks of Electro Industries/GaugeTech.
Communicator EXT™ is a trademark of Electro Industries/GaugeTech.

This page intentionally left blank.

Customer Service and Support

Customer support is available 9:00 am to 4:30 pm, Eastern Standard Time, Monday through Friday. Please have the model, serial number and a detailed problem description available. If the problem concerns a particular reading, please have all meter readings available. When returning any merchandise to EIG, a return materials authorization number is required. For customer or technical assistance, repair or calibration, phone 516-334-0870 or fax 516-338-4741.

Product Warranty

Electro Industries/GaugeTech warrants all products to be free from defects in material and workmanship for a period of four years from the date of shipment. During the warranty period, we will, at our option, either repair or replace any product that proves to be defective.

To exercise this warranty, fax or call our customer-support department. You will receive prompt assistance and return instructions. Send the instrument, transportation prepaid, to EIG at 1800 Shames Drive, Westbury, NY 11590. Repairs will be made and the instrument will be returned.

This warranty does not apply to defects resulting from unauthorized modification, misuse, or use for any reason other than electrical power monitoring. The Nexus® 1262/1272 meter is not a user-serviceable product.

THIS WARRANTY IS IN LIEU OF ALL OTHER WARRANTIES, EXPRESSED OR IMPLIED, INCLUDING ANY IMPLIED WARRANTY OF MERCHANTABILITY OR FITNESS FOR A PARTICULAR PURPOSE. ELECTRO INDUSTRIES/GAUGETECH SHALL NOT BE LIABLE FOR ANY INDIRECT, SPECIAL OR CONSEQUENTIAL DAMAGES ARISING FROM ANY AUTHORIZED OR UNAUTHORIZED USE OF ANY ELECTRO INDUSTRIES/GAUGETECH PRODUCT. LIABILITY SHALL BE LIMITED TO THE ORIGINAL COST OF THE PRODUCT SOLD.

Use of Product for Protection

Our products are not to be used for primary over-current protection. Any protection feature in our products is to be used for alarm or secondary protection only.

Statement of Calibration

Our instruments are inspected and tested in accordance with specifications published by Electro Industries/GaugeTech. The accuracy and a calibration of our instruments are traceable to the National Institute of Standards and Technology through equipment that is calibrated at planned intervals by comparison to certified standards.

Disclaimer

The information presented in this publication has been carefully checked for reliability; however, no responsibility is assumed for inaccuracies. The information contained in this document is subject to change without notice.

This symbol indicates that the operator must refer to an explanation in the operating instructions. Please see chapters 3, 6, 11 and 12 for important safety information regarding installation and hookup of the Nexus® 1262/1272 meter.

About Electro Industries/GaugeTech (EIG)

Founded in 1975 by engineer and inventor Dr. Samuel Kagan, Electro Industries/GaugeTech changed the face of power monitoring forever with its first breakthrough innovation: an affordable, easy-to-use AC power meter.

Thirty years since its founding, Electro Industries/GaugeTech, the leader in power monitoring and control, continues to revolutionize the industry with the highest quality, cutting edge power monitoring and control technology on the market today. An ISO 9001:2000 certified company, EIG sets the industry standard for advanced power quality and reporting, revenue metering and substation data acquisition and control. EIG products can be found on site at mainly all of today's leading manufacturers, industrial giants and utilities.

EIG products are primarily designed, manufactured, tested and calibrated at our facility in Westbury, New York.

This page intentionally left blank.

Table of Contents

1:Three-Phase Power Measurement	**1-1**
1.1: Three-Phase System Configurations	1-1
1.1.1: Wye Connection	1-1
1.1.2: Delta Connection	1-4
1.2: Power, Energy and Demand	1-8
1.3: Reactive Energy and Power Factor	1-12
1.4: Harmonic Distortion	1-14
1.5: Power Quality	1-17
2: Meter Overview	**2-1**
2.1: The Nexus® 1262/1272 Multi-parameter Revenue Meter	2-1
2.2: Accu-Measure™ Technology - Theory of Operation	2-1
2.3: Advanced Measurement Functionality	2-4
2.3.1: Advanced Revenue Billing Capability	2-4
2.3.2: Communications and I/O Capabilities	2-6
2.3.3: Display Screens	2-8
2.3.4: Additional Switches	2-8
2.3.5: Nexus® External I/O Modules	2-8
2.3.6: Optional P40N/P40N+, P41N+ and P43N+ LED Remote Displays	2-8
2.4: Nexus® 1262/1272 Meter Forms	2-9
2.5: Nexus® 1262/1272 Meter Accuracy	2-10
2.6: Nexus® 1262/1272 Meter Specifications Overview	2-10
2.7: Nexus® 1262/1272 Meter Logging Specifications	2-15
2.8: DNP V3.00 Level 2	2-15
3: Operating Instructions	**3-1**
3.1: Nameplate Information	3-1
3.2: Basic Operation	3-4
3.3: LCD Display Information	3-6
3.3.1: Finding Your Display's Firmware Versions	3-9

3.4: Nexus® 1262/1272 Programmable Display Navigation Map	3-10
3.5: Using the Display Configurator	3-11
3.6: Using the Base Programmable Display	3-28
3.6.1: Pre-Programmed Display Screens	3-30
4: Performing Meter Testing	**4-1**
4.1: Testing Tools	4-1
4.1.1: Test Pulse LED	4-2
4.1.2: LCD Display	4-2
4.2: Test Mode	4-3
4.2.1: Entering Test Mode	4-3
4.2.2: Using Test Mode	4-3
4.2.3: Test Mode Preset Accumulators	4-5
4.2.4: Exiting Test Mode	4-8
5: Serial Communication Wiring	**5-1**
5.1: Communication Overview	5-1
5.2: Communicating to the Meter through the ANSI Type II Optical Port	5-2
5.3: RS485 Serial Communication	5-4
5.3.1: RS485 Wiring Fundamentals - (Port 1 and Port 4)	5-4
5.3.2: Using the Unicom 2500	5-6
5.3.3: RJ11 (Telephone Line) Connection—Meter with INP2 (Internal Modem with Dial In/Dial Out) Option	5-8
5.3.4: RJ45 Connection—Meter with INP200 (10/100BaseT) Option	5-8
5.3.5: Modem/Ethernet Connection—Meter with INP202 (Combo Card) Option	5-8
5.3.6: RS485 Connection - Meter to the P40N/P40N+/P41N+P43N+ LED Display	5-10
5.3.7: Communication Ports on the I/O Modules	5-12
5.3.8: RS485 Connection—Meter to I/O Modules	5-12
5.3.9: Steps to Determine Power Needed	5-15
5.3.10: Remote Communication Over Telephone Lines Using the RS485 Port	5-16

5.3.11: Programming Modems for Remote Communication 5-17
5.3.12: Selected Modem Strings 5-18
5.3.13: High Speed Inputs Connection 5-18
5.3.14: IRIG-B Connections 5-19
5.3.15: Time Synchronization Alternatives 5-22
5.4: INP2 Internal Modem with Dial-In/Dial-Out Option 5-23
5.4.1: Hardware Overview 5-23
5.4.2: Hardware Connection 5-23
5.4.3: Dial-In Function 5-24
5.4.4: Dial-Out Function 5-24
5.5: INP200 Onboard Ethernet 5-26
5.5.1: Hardware Overview 5-26
5.5.2: Hardware Connection 5-27
5.6: INP202 Ethernet/Modem Combination 5-31
5.6.1: Hardware Overview 5-31
5.6.2: Hardware Connection 5-31
5.7: Factory Settings 5-33
6: Hardware Installation 6-1
6.1: Mounting the Nexus® Socket Meter 6-1
6.1.1: Cable Color Key 6-5
6.2: Internal Battery Installation and Maintenance 6-7
6.2.1: Battery Safety and Disposal 6-10
6.3: Mounting the External Displays 6-10
6.4: Mounting the Nexus® External I/O Modules 6-13
7: Time-of-Use Function 7-1
7.1: Introduction 7-1
7.2: The Nexus® Meter's TOU Calendar 7-1
7.3: TOU Frozen and Active Registers 7-2
7.4: Updating, Retrieving and Replacing TOU Calendars 7-2
7.5: Daylight Savings and Demand 7-3

8: Transformer Loss Compensation **8-1**
8.1: Introduction 8-1
8.2: Nexus® 1262/1272 Meter's Transformer Loss Compensation 8-4
8.2.1: Loss Compensation in Three Element Installations 8-5
8.2.1.1: Three-Element Loss Compensation Worksheet 8-6
9: Using the External Displays **9-1**
9.1: Overview 9-1
9.2: Nexus® P40N/P40N+ LED External Display 9-1
9.3: Dynamic Readings Mode 9-6
9.4: Navigation Map of Dynamic Readings Mode 9-10
9.5: Nexus® Information Mode 9-11
9.6: Navigation Map of Nexus® Information Mode 9-13
9.7: Display Features Mode 9-14
9.8: Navigation Map of Display Features Mode 9-16
9.9: Optional P40N+ LED External Remote Display Specifications 9-17
10: External I/O Modules **10-1**
10.1: Hardware Overview 10-1
10.1.1: Port Overview 10-2
10.2: I/O Module Installation 10-2
10.2.1: Power Source for I/O Modules 10-3
10.3: Using the PSIO with Multiple I/O Modules 10-4
10.3.1: Steps for Attaching Multiple I/O Modules 10-5
10.4: Factory Settings and Reset Button 10-6
10.5: Analog Transducer Signal Output Modules 10-7
10.5.1: Overview 10-7
10.5.2: Normal Mode 10-8
10.6: Analog Input Modules 10-9
10.6.1: Overview 10-9
10.6.2: Normal Mode 10-10
10.7: Digital Dry Contact Relay Output (Form C) Module 10-11

10.7.1: Overview 10-11
10.7.2: Communication 10-12
10.7.3: Normal Mode 10-12
10.8: Digital Solid State Pulse Output (KYZ) Module 10-13
10.8.1: Overview 10-13
10.8.2: Communication 10-14
10.8.3: Normal Mode 10-14
10.9: Digital Status Input Module 10-16
10.9.1: Overview 10-16
10.9.2: Communication 10-17
10.9.3: Normal Mode 10-17
11: Electrical Installation 11-1
11.1: Considerations when Installing Meters 11-1
11.2: Blade Configuration for for Forms 9S, 36S, and 45S 11-3
11.3: Wiring Diagrams 11-4
11.4: 9S Meter Mounted in S/A Adapter 11-21
12: Switchboard Meter 12-1
12.1: Introduction 12-1
12.2: Labels 12-2
12.3: Specifications and Dimensions 12-3
12.4: Installation 12-6
12.5: Wiring Diagrams 12-8

13: Meter Calculations 13-1
13.1: Measurements and Calculations 13-1
13.2: Demand Integrators 13-7
14: EN50160/IEC61000-4-15 Flicker 14-1
14.1: Overview 14-1
14.2: Theory of Operation 14-1

A: Transformer Loss Compensation Spreadsheet and Examples **A-1**

A.1: Calculating Values **A-1**

A.2: Excel Spreadsheet with Example Numbers **A-1**

B: Blade Configuration for Forms 9S, 36S and 45S **B-1**

B.1: 1262/1272 Forms B-1

B.2: Blade Configuration Drawings B-2

Glossary **GL-1**

1:Three-Phase Power Measurement

This introduction to three-phase power and power measurement is intended to provide only a brief overview of the subject. The professional meter engineer or meter technician should refer to more advanced documents such as the EEI Handbook for Electricity Metering and the application standards for more in-depth and technical coverage of the subject.

1.1: Three-Phase System Configurations

Three-phase power is most commonly used in situations where large amounts of power will be used because it is a more effective way to transmit the power and because it provides a smoother delivery of power to the end load. There are two commonly used connections for three-phase power, a wye connection or a delta connection. Each connection has several different manifestations in actual use.

When attempting to determine the type of connection in use, it is a good practice to follow the circuit back to the transformer that is serving the circuit. It is often not possible to conclusively determine the correct circuit connection simply by counting the wires in the service or checking voltages. Checking the transformer connection will provide conclusive evidence of the circuit connection and the relationships between the phase voltages and ground.

1.1.1: Wye Connection

The wye connection is so called because when you look at the phase relationships and the winding relationships between the phases it looks like a Y. Figure 1.1 depicts the winding relationships for a wye-connected service. In a wye service the neutral (or center point of the wye) is typically grounded. This leads to common voltages of 208/120 and 480/277 (where the first number represents the phase-to-phase voltage and the second number represents the phase-to-ground voltage).

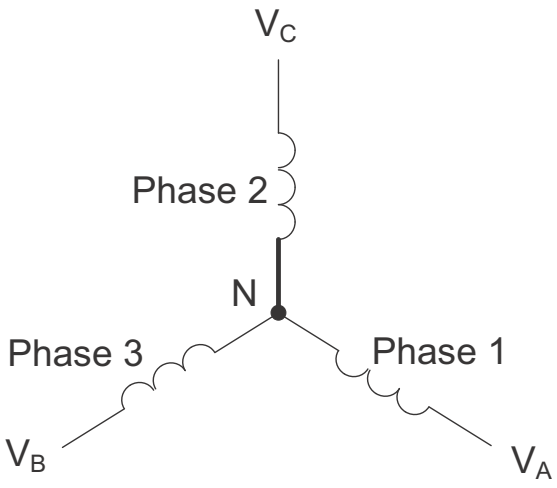


Figure 1.1: Three-phase Wye Winding

The three voltages are separated by 120° electrically. Under balanced load conditions the currents are also separated by 120°. However, unbalanced loads and other conditions can cause the currents to depart from the ideal 120° separation. Three-phase voltages and currents are usually represented with a phasor diagram. A phasor diagram for the typical connected voltages and currents is shown in Figure 1.2.

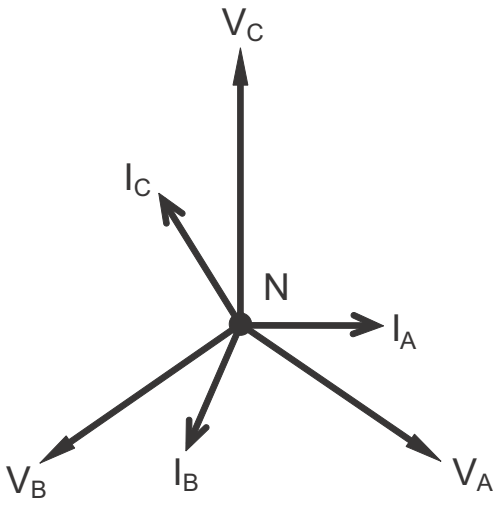


Figure 1.2: Phasor Diagram Showing Three-phase Voltages and Currents

The phasor diagram shows the 120^{o} angular separation between the phase voltages. The phase-to-phase voltage in a balanced three-phase wye system is 1.732 times the phase-to-neutral voltage. The center point of the wye is tied together and is typically grounded. Table 1.1 shows the common voltages used in the United States for wye-connected systems.

Phase to Ground Voltage	Phase to Phase Voltage
120 volts	208 volts
277 volts	480 volts
2,400 volts	4,160 volts
7,200 volts	12,470 volts
7,620 volts	13,200 volts

Table 1: Common Phase Voltages on Wye Services

Usually a wye-connected service will have four wires: three wires for the phases and one for the neutral. The three-phase wires connect to the three phases (as shown in Figure 1.1). The neutral wire is typically tied to the ground or center point of the wye.

In many industrial applications the facility will be fed with a four-wire wye service but only three wires will be run to individual loads. The load is then often referred to as a delta-connected load but the service to the facility is still a wye service; it contains four wires if you trace the circuit back to its source (usually a transformer). In this type of connection the phase to ground voltage will be the phase-to-ground voltage indicated in Table 1, even though a neutral or ground wire is not physically present at the load. The transformer is the best place to determine the circuit connection type because this is a location where the voltage reference to ground can be conclusively identified.

1.1.2: Delta Connection

Delta-connected services may be fed with either three wires or four wires. In a three-phase delta service the load windings are connected from phase-to-phase rather than from phase-to-ground. Figure 1.3 shows the physical load connections for a delta service.

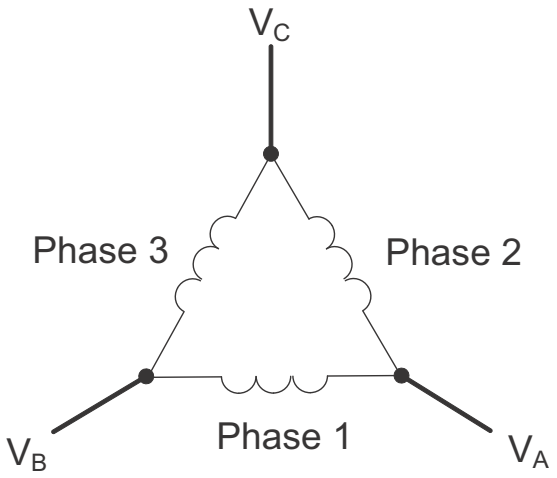


Figure 1.3: Three-phase Delta Winding Relationship

In this example of a delta service, three wires will transmit the power to the load. In a true delta service, the phase-to-ground voltage will usually not be balanced because the ground is not at the center of the delta.

Figure 1.4 shows the phasor relationships between voltage and current on a three-phase delta circuit.

In many delta services, one corner of the delta is grounded. This means the phase to ground voltage will be zero for one phase and will be full phase-to-phase voltage for the other two phases. This is done for protective purposes.

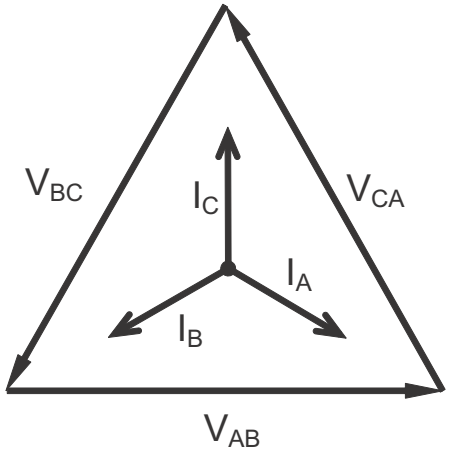


Figure 1.4: Phasor Diagram, Three-Phase Voltages and Currents, Delta-Connected

Another common delta connection is the four-wire, grounded delta used for lighting loads. In this connection the center point of one winding is grounded. On a 120/240 volt, four-wire, grounded delta service the phase-to-ground voltage would be 120 volts on two phases and 208 volts on the third phase. Figure 1.5 shows the phasor diagram for the voltages in a three-phase, four-wire delta system.

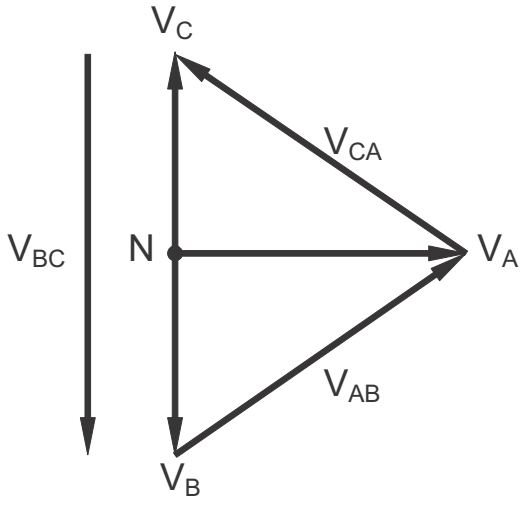


Figure 1.5: Phasor Diagram Showing Three-phase Four-Wire Delta-Connected System

1.1.3: Blondell's Theorem and Three Phase Measurement

In 1893 an engineer and mathematician named Andre E. Blondell set forth the first scientific basis for polyphase metering. His theorem states:

If energy is supplied to any system of conductors through N wires, the total power in the system is given by the algebraic sum of the readings of N wattmeters so arranged that each of the N wires contains one current coil, the corresponding potential coil being connected between that wire and some common point. If this common point is on one of the N wires, the measurement may be made by the use of N-1 Wattmeters.

The theorem may be stated more simply, in modern language:

In a system of N conductors, N-1 meter elements will measure the power or energy taken provided that all the potential coils have a common tie to the conductor in which there is no current coil.

Three-phase power measurement is accomplished by measuring the three individual phases and adding them together to obtain the total three phase value. In older analog meters, this measurement was accomplished using up to three separate elements. Each element combined the single-phase voltage and current to produce a torque on the meter disk. All three elements were arranged around the disk so that the disk was subjected to the combined torque of the three elements. As a result the disk would turn at a higher speed and register power supplied by each of the three wires.

According to Blondell's Theorem, it was possible to reduce the number of elements under certain conditions. For example, a three-phase, three-wire delta system could be correctly measured with two elements (two potential coils and two current coils) if the potential coils were connected between the three phases with one phase in common.

In a three-phase, four-wire wye system it is necessary to use three elements. Three voltage coils are connected between the three phases and the common neutral conductor. A current coil is required in each of the three phases.

In modern digital meters, Blondell's Theorem is still applied to obtain proper metering. The difference in modern meters is that the digital meter measures each phase voltage and current and calculates the single-phase power for each phase. The meter then sums the three phase powers to a single three-phase reading.

Some digital meters calculate the individual phase power values one phase at a time. This means the meter samples the voltage and current on one phase and calculates a power value. Then it samples the second phase and calculates the power for the second phase. Finally, it samples the third phase and calculates that phase power. After sampling all three phases, the meter combines the three readings to create the equivalent three-phase power value. Using mathematical averaging techniques, this method can derive a quite accurate measurement of three-phase power.

More advanced meters actually sample all three phases of voltage and current simultaneously and calculate the individual phase and three-phase power values. The advantage of simultaneous sampling is the reduction of error introduced due to the difference in time when the samples were taken.

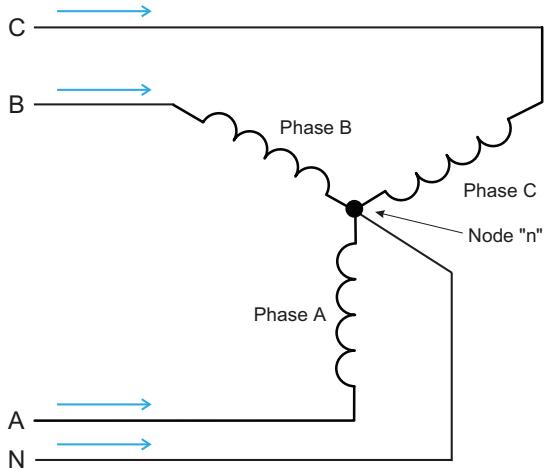


Figure 1.6: Three-Phase Wye Load Illustrating Kirchhoff's Law and Blondell's Theorem

Blondell's Theorem is a derivation that results from Kirchhoff's Law. Kirchhoff's Law states that the sum of the currents into a node is zero. Another way of stating the same thing is that the current into a node (connection point) must equal the current out of the node. The law can be applied to measuring three-phase loads. Figure 1.6 shows a typical connection of a three-phase load applied to a three-phase, four-wire service. Krichhoff's Law holds that the sum of currents A, B, C and N must equal zero or that the sum of currents into Node "n" must equal zero.

If we measure the currents in wires A, B and C, we then know the current in wire N by Kirchhoff's Law and it is not necessary to measure it. This fact leads us to the conclusion of Blondell's Theorem- that we only need to measure the power in three of

the four wires if they are connected by a common node. In the circuit of Figure 1.6 we must measure the power flow in three wires. This will require three voltage coils and three current coils (a three-element meter). Similar figures and conclusions could be reached for other circuit configurations involving Delta-connected loads.

1.2: Power, Energy and Demand

It is quite common to exchange power, energy and demand without differentiating between the three. Because this practice can lead to confusion, the differences between these three measurements will be discussed.

Power is an instantaneous reading. The power reading provided by a meter is the present flow of watts. Power is measured immediately just like current. In many digital meters, the power value is actually measured and calculated over a one second interval because it takes some amount of time to calculate the RMS values of voltage and current. But this time interval is kept small to preserve the instantaneous nature of power.

Energy is always based on some time increment; it is the integration of power over a defined time increment. Energy is an important value because almost all electric bills are based, in part, on the amount of energy used.

Typically, electrical energy is measured in units of kilowatt-hours (kWh). A kilowatt-hour represents a constant load of one thousand watts (one kilowatt) for one hour. Stated another way, if the power delivered (instantaneous watts) is measured as 1,000 watts and the load was served for a one hour time interval then the load would have absorbed one kilowatt-hour of energy. A different load may have a constant power requirement of 4,000 watts. If the load were served for one hour it would absorb four kWh. If the load were served for 15 minutes it would absorb ¼ of that total or one kWh.

Figure 1.7 shows a graph of power and the resulting energy that would be transmitted as a result of the illustrated power values. For this illustration, it is assumed that the power level is held constant for each minute when a measurement is taken. Each bar in the graph will represent the power load for the one-minute increment of time. In real life the power value moves almost constantly.

The data from Figure 1.7 is reproduced in Table 2 to illustrate the calculation of energy. Since the time increment of the measurement is one minute and since we

specified that the load is constant over that minute, we can convert the power reading to an equivalent consumed energy reading by multiplying the power reading times 1/60 (converting the time base from minutes to hours).

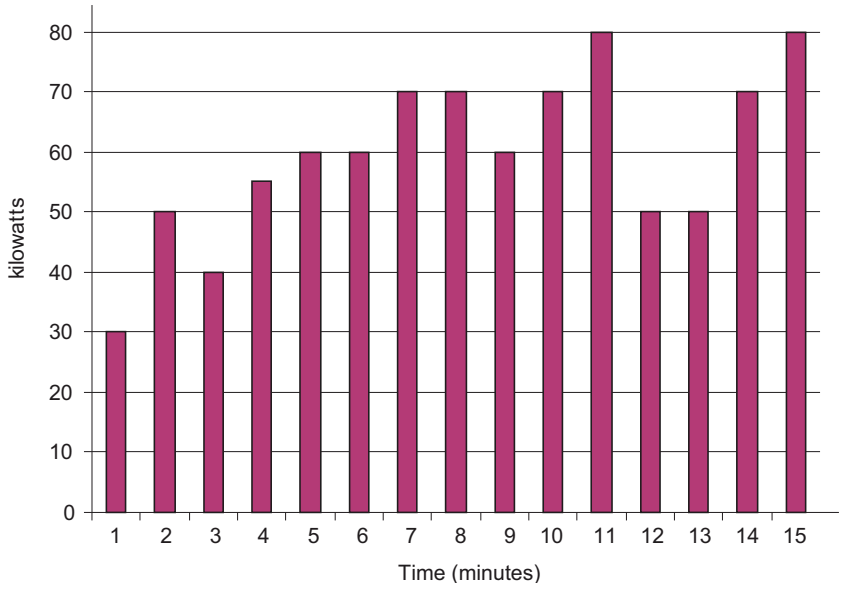


Figure 1.7: Power Use over Time

Time Interval (minute)	Power (kW)	Energy (kWh)	Accumulated Energy (kWh)
1	30	0.50	0.50
2	50	0.83	1.33
3	40	0.67	2.00
4	55	0.92	2.92
5	60	1.00	3.92
6	60	1.00	4.92
7	70	1.17	6.09
8	70	1.17	7.26
9	60	1.00	8.26
10	70	1.17	9.43
11	80	1.33	10.76
12	50	0.83	12.42
13	50	0.83	12.42
14	70	1.17	13.59
15	80	1.33	14.92

Table 1.2: Power and Energy Relationship over Time

As in Table 1.2, the accumulated energy for the power load profile of Figure 1.7 is 14.92 kWh.

Demand is also a time-based value. The demand is the average rate of energy use over time. The actual label for demand is kilowatt-hours/hour but this is normally reduced to kilowatts. This makes it easy to confuse demand with power, but demand is not an instantaneous value. To calculate demand it is necessary to accumulate the energy readings (as illustrated in Figure 1.7) and adjust the energy reading to an hourly value that constitutes the demand.

In the example, the accumulated energy is 14.92 kWh. But this measurement was made over a 15-minute interval. To convert the reading to a demand value, it must be normalized to a 60-minute interval. If the pattern were repeated for an additional three 15-minute intervals the total energy would be four times the measured value or

59.68 kWh. The same process is applied to calculate the 15-minute demand value. The demand value associated with the example load is 59.68 kWh/hr or 59.68 kWd. Note that the peak instantaneous value of power is 80 kW, significantly more than the demand value.

Figure 1.8 shows another example of energy and demand. In this case, each bar represents the energy consumed in a 15-minute interval. The energy use in each interval typically falls between 50 and 70 kWh. However, during two intervals the energy rises sharply and peaks at 100 kWh in interval number 7. This peak of usage will result in setting a high demand reading. For each interval shown the demand value would be four times the indicated energy reading. So interval 1 would have an associated demand of 240 kWh/hr. Interval 7 will have a demand value of 400 kWh/hr. In the data shown, this is the peak demand value and would be the number that would set the demand charge on the utility bill.

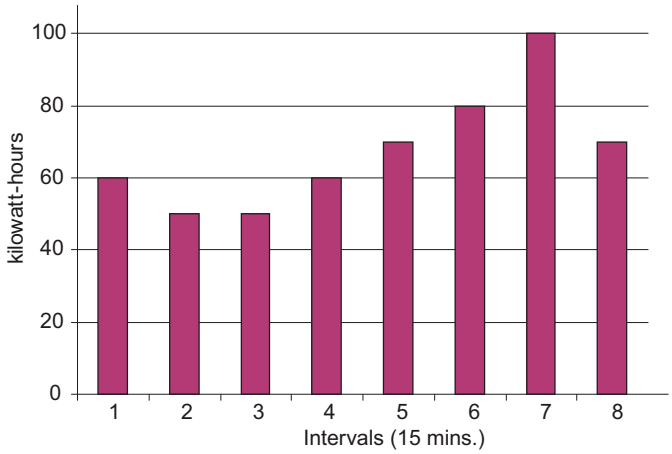


Figure 1.8: Energy Use and Demand

As can be seen from this example, it is important to recognize the relationships between power, energy and demand in order to control loads effectively or to monitor use correctly.

1.3: Reactive Energy and Power Factor

The real power and energy measurements discussed in the previous section relate to the quantities that are most used in electrical systems. But it is often not sufficient to only measure real power and energy. Reactive power is a critical component of the total power picture because almost all real-life applications have an impact on reactive power. Reactive power and power factor concepts relate to both load and generation applications. However, this discussion will be limited to analysis of reactive power and power factor as they relate to loads. To simplify the discussion, generation will not be considered.

Real power (and energy) is the component of power that is the combination of the voltage and the value of corresponding current that is directly in phase with the voltage. However, in actual practice the total current is almost never in phase with the voltage. Since the current is not in phase with the voltage, it is necessary to consider both the inphase component and the component that is at quadrature (angularly rotated 90^o or perpendicular) to the voltage. Figure 1.9 shows a single-phase voltage and current and breaks the current into its in-phase and quadrature components.

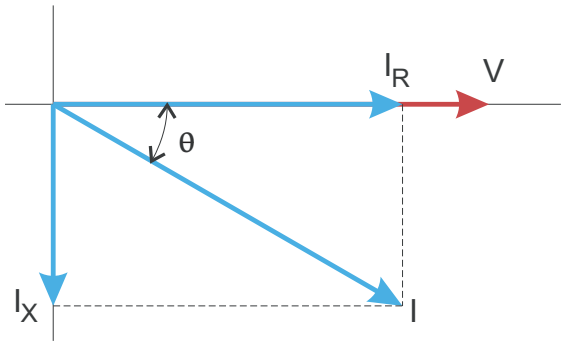


Figure 1.9: Voltage and Complex Current

The voltage (V) and the total current (I) can be combined to calculate the apparent power or VA. The voltage and the in-phase current (I_R) are combined to produce the real power or watts. The voltage and the quadrature current (I_X) are combined to calculate the reactive power.

The quadrature current may be lagging the voltage (as shown in Figure 1.9) or it may lead the voltage. When the quadrature current lags the voltage the load is requiring both real power (watts) and reactive power (VARs). When the quadrature current

leads the voltage the load is requiring real power (watts) but is delivering reactive power (VARs) back into the system; that is VARs are flowing in the opposite direction of the real power flow.

Reactive power (VARs) is required in all power systems. Any equipment that uses magnetization to operate requires VARs. Usually the magnitude of VARs is relatively low compared to the real power quantities. Utilities have an interest in maintaining VAR requirements at the customer to a low value in order to maximize the return on plant invested to deliver energy. When lines are carrying VARs, they cannot carry as many watts. So keeping the VAR content low allows a line to carry its full capacity of watts. In order to encourage customers to keep VAR requirements low, some utilities impose a penalty if the VAR content of the load rises above a specified value.

A common method of measuring reactive power requirements is power factor. Power factor can be defined in two different ways. The more common method of calculating power factor is the ratio of the real power to the apparent power. This relationship is expressed in the following formula:

Total PF = real power / apparent power = watts/VA

This formula calculates a power factor quantity known as Total Power Factor. It is called Total PF because it is based on the ratios of the power delivered. The delivered power quantities will include the impacts of any existing harmonic content. If the voltage or current includes high levels of harmonic distortion the power values will be affected. By calculating power factor from the power values, the power factor will include the impact of harmonic distortion. In many cases this is the preferred method of calculation because the entire impact of the actual voltage and current are included.

A second type of power factor is Displacement Power Factor. Displacement PF is based on the angular relationship between the voltage and current. Displacement power factor does not consider the magnitudes of voltage, current or power. It is solely based on the phase angle differences. As a result, it does not include the impact of harmonic distortion. Displacement power factor is calculated using the following equation:

$$\text{Displacement PF} = \cos\theta$$

where θ is the angle between the voltage and the current (see Fig. 1.9).

In applications where the voltage and current are not distorted, the Total Power Factor will equal the Displacement Power Factor. But if harmonic distortion is present, the two power factors will not be equal.

1.4: Harmonic Distortion

Harmonic distortion is primarily the result of high concentrations of non-linear loads. Devices such as computer power supplies, variable speed drives and fluorescent light ballasts make current demands that do not match the sinusoidal waveform of AC electricity. As a result, the current waveform feeding these loads is periodic but not sinusoidal. Figure 1.10 shows a normal, sinusoidal current waveform. This example has no distortion.

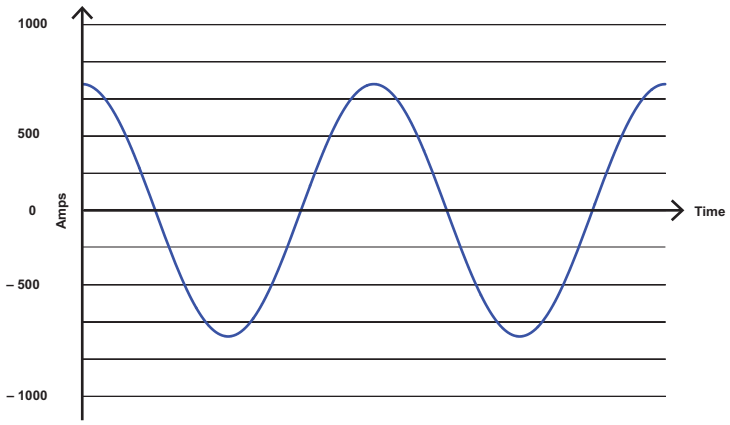


Figure 1.10: Nondistorted Current Waveform

Figure 1.11 shows a current waveform with a slight amount of harmonic distortion. The waveform is still periodic and is fluctuating at the normal 60 Hz frequency. However, the waveform is not a smooth sinusoidal form as seen in Figure 1.10.

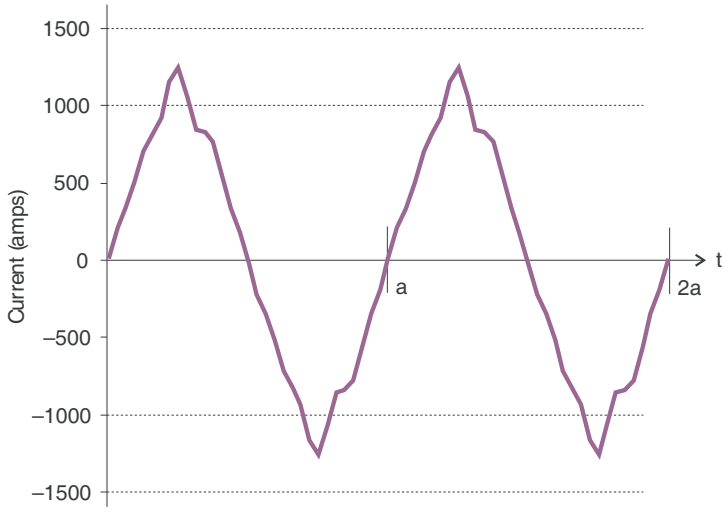


Figure 1.11: Distorted Current Waveform

The distortion observed in Figure 1.11 can be modeled as the sum of several sinusoidal waveforms of frequencies that are multiples of the fundamental 60 Hz frequency. This modeling is performed by mathematically disassembling the distorted waveform into a collection of higher frequency waveforms.

These higher frequency waveforms are referred to as harmonics. Figure 1.12 shows the content of the harmonic frequencies that make up the distortion portion of the waveform in Figure 1.11.

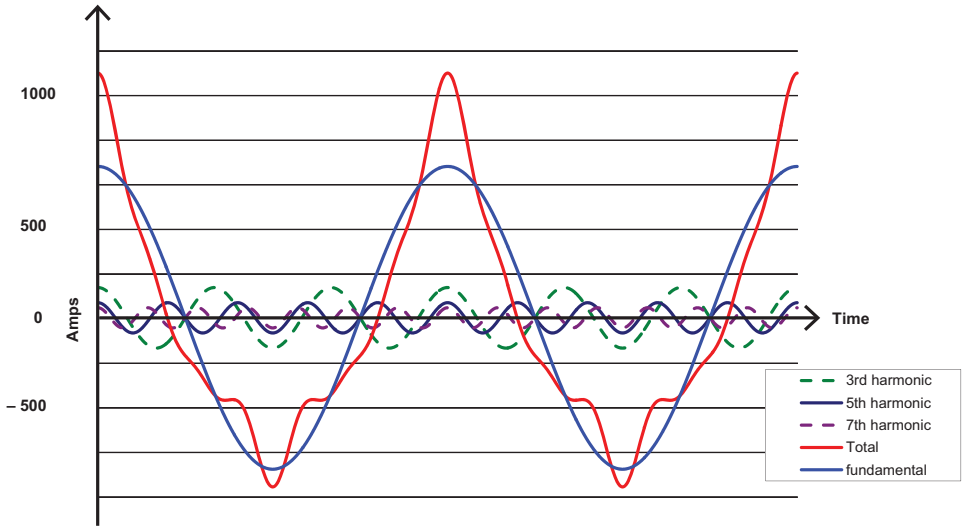


Figure 1.12: Waveforms of the Harmonics

The waveforms shown in Figure 1.12 are not smoothed but do provide an indication of the impact of combining multiple harmonic frequencies together.

When harmonics are present it is important to remember that these quantities are operating at higher frequencies. Therefore, they do not always respond in the same manner as 60 Hz values.

Inductive and capacitive impedance are present in all power systems. We are accustomed to thinking about these impedances as they perform at 60 Hz. However, these impedances are subject to frequency variation.

$$X_L = j\omega L \quad \text{and}$$

$$X_C = 1/j\omega C$$

At 60 Hz, $\omega = 377$; but at 300 Hz (5th harmonic) $\omega = 1{,}885$. As frequency changes impedance changes and system impedance characteristics that are normal at 60 Hz may behave entirely differently in the presence of higher order harmonic waveforms.

Traditionally, the most common harmonics have been the low order, odd frequencies, such as the 3rd, 5th, 7th, and 9th. However newer, new-linear loads are introducing significant quantities of higher order harmonics.

Since much voltage monitoring and almost all current monitoring is performed using instrument transformers, the higher order harmonics are often not visible. Instrument transformers are designed to pass 60 Hz quantities with high accuracy. These devices, when designed for accuracy at low frequency, do not pass high frequencies with high accuracy; at frequencies above about 1200 Hz they pass almost no information. So when instrument transformers are used, they effectively filter out higher frequency harmonic distortion making it impossible to see.

However, when monitors can be connected directly to the measured circuit (such as direct connection to a 480 volt bus) the user may often see higher order harmonic distortion. An important rule in any harmonics study is to evaluate the type of equipment and connections before drawing a conclusion. Not being able to see harmonic distortion is not the same as not having harmonic distortion.

It is common in advanced meters to perform a function commonly referred to as waveform capture. Waveform capture is the ability of a meter to capture a present

picture of the voltage or current waveform for viewing and harmonic analysis. Typically a waveform capture will be one or two cycles in duration and can be viewed as the actual waveform, as a spectral view of the harmonic content, or a tabular view showing the magnitude and phase shift of each harmonic value. Data collected with waveform capture is typically not saved to memory. Waveform capture is a real-time data collection event.

Waveform capture should not be confused with waveform recording that is used to record multiple cycles of all voltage and current waveforms in response to a transient condition.

1.5: Power Quality

Power quality can mean several different things. The terms "power quality" and "power quality problem" have been applied to all types of conditions. A simple definition of "power quality problem" is any voltage, current or frequency deviation that results in mis-operation or failure of customer equipment or systems. The causes of power quality problems vary widely and may originate in the customer equipment, in an adjacent customer facility or with the utility.

In his book Power Quality Primer, Barry Kennedy provided information on different types of power quality problems. Some of that information is summarized in Table 1.3.

Cause	Disturbance Type	Source
Impulse transient	Transient voltage disturbance, sub-cycle duration	Lightning Electrostatic discharge Load switching Capacitor switching
Oscillatory transient with decay	Transient voltage, sub-cycle duration	Line/cable switching Capacitor switching Load switching
Sag/swell	RMS voltage, multiple cycle duration	Remote system faults
Interruptions	RMS voltage, multiple seconds or longer duration	System protection Circuit breakers Fuses Maintenance
Under voltage/over voltage	RMS voltage, steady state, multiple seconds or longer duration	Motor starting Load variations Load dropping
Voltage flicker	RMS voltage, steady state, repetitive condition	Intermittent loads Motor starting Arc furnaces
Harmonic distortion	Steady state current or voltage, long-term duration	Non-linear loads System resonance

Table 1.3: Typical Power Quality Problems and Sources

It is often assumed that power quality problems originate with the utility. While it is true that may power quality problems can originate with the utility system, many problems originate with customer equipment. Customer-caused problems may manifest themselves inside the customer location or they may be transported by the utility system to another adjacent customer. Often, equipment that is sensitive to power quality problems may in fact also be the cause of the problem.

If a power quality problem is suspected, it is generally wise to consult a power quality professional for assistance in defining the cause and possible solutions to the problem.

2: Meter Overview

2.1: The Nexus® 1262/1272 Multi-parameter Revenue Meter

The Nexus® 1262/1272 transformer-rated, polyphase revenue meter is a unique collection of metering technologies designed to fulfill advanced metering requirements. It provides high-accuracy power and energy measurements of Voltage, current and all power values, data logging and power quality recording. The unit makes the data available through the display, connected systems and historic logs.

2.2: Accu-Measure™ Technology - Theory of Operation

The advanced metering capability of the Nexus® 1262/1272 device is a result of EIG's Accu-Measure™ Digital Sensing Technology. Accu-Measure™ technology is a combination of high-speed sampling, high-resolution measurement and high-speed calculation. All Voltage and current waveforms are sampled and RMS values calculated continuously every cycle. Values of Voltage, current and power are produced every three cycles and every second.

Figure 2.1 illustrates the key processes operating within the Nexus® 1262/1272 meter. The meter allows for four types of inputs and can provide outputs to an integrated display, pulse outputs and several communication ports.

Nexus® 1262/1272 Meter Processing

Voltage and current signals enter the meter and are sampled at up to 256 samples per cycle. Each sample is resolved to a digital value using 16-bit analog-to-digital converters. The Nexus® 1272 meter has two 16-bit A/D converters and the Nexus® 1262 meter has one. The first converter, which both meters have, is for the real-time measurements. The second converter, unique to the 1272, is for the waveform recorder. The use of two A/D converters ensures that both signals have maximum resolution, accuracy and integrity. The second converter also isolates energy sampling and calculations from the waveform fault recording requirements. This provides both advanced energy and advanced waveform analysis.

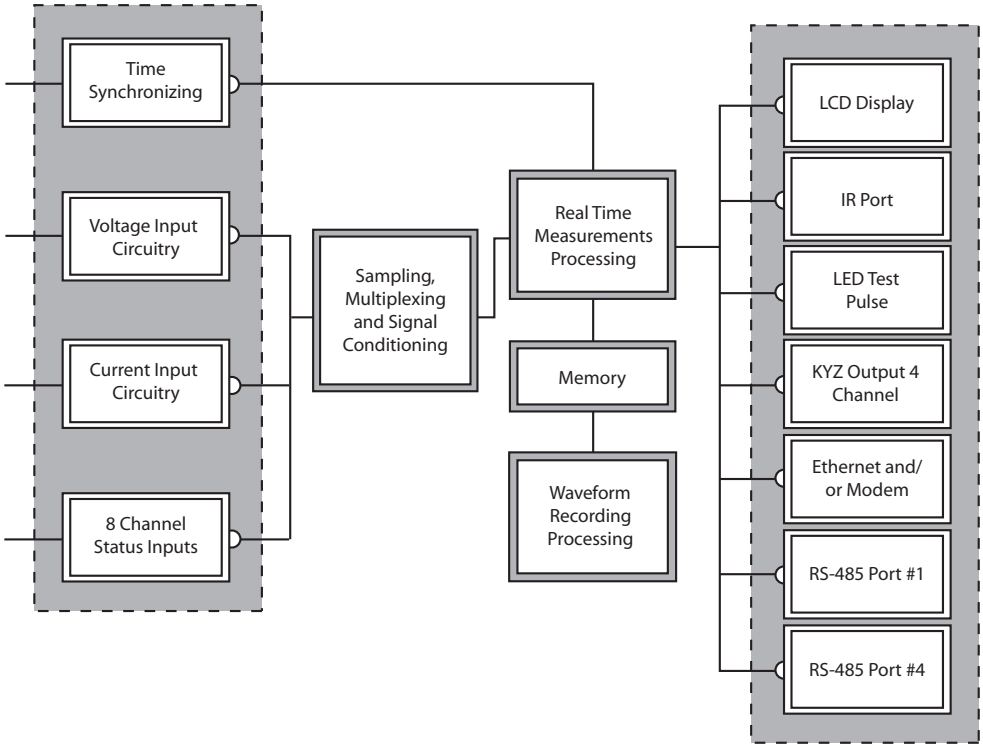


Figure 2.1: How the Nexus® 1262/1272 Meter Processes Inputs

The digitized signals are then passed to the appropriate processor. Real-time measurements are calculated in one processor and made available for meter readings and historical logs. A separate processor performs waveform recording. Calculated data and logs are stored in memory for delivery to displays, external systems and download processes.

The meter includes a time synchronizing input port that accepts an industry standard IRIG-B signal to synchronize meter time to standard universal time. If there is no IRIG-B signal, the meter uses an internal 20 ppm crystal or the primary power line frequency to keep meter time. The Line Frequency Clock Synchronization feature may be enabled or disabled. If it is not enabled, the internal clock crystal provides time synchronization. All readings and logs are time stamped to the nearest millisecond.

Eight status channels provide input of status or pulse signals. Status inputs are date/time stamped to the nearest millisecond and placed in the event log. Pulse inputs are multiplied by a user-supplied factor and accumulated in reading registers. These accumulated values can also be totalized. This feature makes the Nexus® 1262/1272 meter a good fit in universal metering applications. Additionally, any one input channel can be selected to accept an End of Interval pulse from another meter.

Meter set-up parameters and all historical log data are stored in nonvolatile RAM. The user has multiple log functionality. Data is made available through the onboard display. Display screens are described in Chapter 3. Several additional communication channels operate simultaneously, including the optional Ethernet/Modem Combo Card. External systems can be connected to either of the RS485 ports or the Ethernet/Modem port. Stored data can be downloaded through the RS485 ports, the Ethernet/Modem port or the Optical port.

2.3: Advanced Measurement Functionality

2.3.1: Advanced Revenue Billing Capability

The Nexus® 1262/1272 device is a full four-quadrant power and energy meter with accuracy of within 0.06% of reading at full load unity PF. Energy measurements include: kWh Delivered & Received, kVARh Delivered & Received, kVAh, kVARh, kWh in each quadrant and Total kVAh. The meter measures instantaneous power and provides multiple, simultaneous demand measurements, including time-stamped maximum and minimum readings.

Time of Use

The Nexus® meter's Time of Use functionality offers the following standard capabilities:

- 8 TOU schedules
- Bidirectional consumption and Demand
- 4 seasons/year
- 20-year calendar
- Prior month and prior season readings for each schedule
- Present month and present season readings for each schedule
- Prior season may also be adjusted for a programmable freeze period
- Total-to-date readings for each month
- Total-to-date readings for each season
- Cumulative and continuous cumulative Demand

Load Aggregation/Universal Metering

Using standard pulse inputs, the Nexus® 1262/1272 meter can count pulses from external meters and accumulate usage. The pulse inputs can be used to totalize electrical usage and utility values, such as water or gas use data. Readings include:

- 8 pulse inputs

- Individual accumulating registers
- 4 totalizing registers
- Totalization with Nexus® meter kWh readings

Multiple Demand Windows

The Nexus® 1262/1272 meter simultaneously monitors four demand structures. The unit offers:

- Block Window Demand
- Rolling Window Demand
- Thermal Demand
- Predictive Demand
- Interval length from 1 second to over one hour
- Up to 15 sub-intervals
- End of Interval Pulse Output (with optional 4IPO Internal KYZ capability)
- End of Interval Pulse Input

Time-Stamped Max/Min Demands

The unit gathers Time-stamped Max/Min Demands for all power values. Each of the following values is date/time stamped:

- kW Demand, Delivered & Received, Max/Min
- kVAR Demand, Delivered & Received, Max/Min
- kVAR Coincident with kW Demand
- kVA Demand, Max/Min
- Amps Demand, Max/Min
- Voltage Demand Max/Min

Transformer Loss Compensation

Transformer Loss Compensation adjusts for both copper and iron losses with a simple user setup.

2.3.2: Communications and I/O Capabilities

The Nexus® 1262/1272 meter features advanced communication which utilizes multiple Com ports using open protocols. The meter's multi-port design allows multiple communication connections simultaneously. The Nexus® 1262/1272 system provides a direct digital link, allowing selected data to be gathered without affecting the meter or your data. All of the advanced features of the 1262/1272 are made available through industry-standard Modbus and DNP 3.0 protocols. No proprietary or closed protocols are used.

Standard Communications

- ANSI Type 2 Optical port
- 2 RS485 serial ports
- Modbus RTU/ASCII protocol
- DNP 3.0 Level 2 + protocol
- Speeds up to 115200 bps

Optional Communications

The Nexus® 1262/1272 meter allows you to select an additional port for one of the following uses:

- INP2: Internal 56k Modem with telephone line noise rejection
- INP200: Internal Ethernet TCP/IP (10/100BaseT) with multiple sockets and Modbus TCP and DNP TCP
- INP202: Combination 56k Modem and Internal Ethernet TCP/IP (10/100BaseT)

Standard Internal I/O

Extensive I/O capability is available in conjunction with all metering functions:

- IRIG-B Time Synchronizing to GPS to 1 millisecond resolution
- 8 High-Speed Status Inputs for status detect or of load aggregation/universal metering inputs
- Four KYZ pulse outputs which can be programmed to pulse for any accumulated reading. One of the pulse outputs can also be set for an End-of-Interval Sync Pulse.

Upgradable External I/O

The user can select from the following to connect multiple external I/O Modules for enhanced I/O capability:

- Analog Outputs
- Analog Inputs
- Additional Status Inputs
- KYZ Outputs
- Relay/ Alarm Outputs

Control Options

ElectroLogic™ Relay Control provides user-definable control outputs:

- Action and/or alarm on abnormal condition
- Action on Boolean logic combinations of Inputs or electrical conditions

2.3.3: Display Screens

The Nexus® 1262/1272 meter features a built-in graphical back-lit FSTN LCD display with extended temperature Voltage compensation. This allows you to view energy data and to gather circuit diagnostic data such as Voltage, current, harmonics and phasor information. The display is easily programmable. See Chapter 3 for details on the Programmable Display.

2.3.4: Additional Switches

The Nexus® 1262/1272 meter has additional switches & signals that help in using the unit (see Section 3.2 for more information):

- The Infrared Test Pulse can be set to pulse for +Watt-hour, -Watt-hour, +VAR-hour, -VAR-hour and VA-hour. The pulse uses a time-modulated pulse integration which allows the pulse to be accurate during short duration pulse tests. The pulse integration uses industry-accepted reference standards.
- The Mode Switch (magnetic reed switch) uses a magnet to switch operating modes.
- The Test button is used to access Test Mode.
- The Reset button is used to reset Demand.

2.3.5: Nexus® External I/O Modules

A variety of optional analog or digital I/O modules mount externally to the Nexus® 1262/1272 Socket meter. The Nexus® 1262/1272 unit does not supply power to I/O modules. Use a power supply, such as EIG's PSIO, to power optional I/O modules. See Chapter 10 for details on installation and use of the Nexus® External I/O modules.

2.3.6: Optional P40N/P40N+, P41N+ and P43N+ LED Remote Displays

The Nexus® 1262/1272 Socket meter features a back-lit LCD display built into the face of the meter. In addition, Electro Industries offers optional external LED displays, powered by a power supply (such as the PSIO). The P40N+ (and legacy P40N), P41N+ and P43N+ displays provide easy access to information stored in the meter if an additional display is required for remote access. See Chapter 9 for further details.

2.4: Nexus® 1262/1272 Meter Forms

The Nexus® 1262/1272 Socket meter offers three supported S-Based meter forms based on the rated Voltage and hookup required by the user. Below are the form specifications.

Form 9S can be ordered in an A-Base (Order Form 9A).

See Chapter 11 for corresponding Wiring diagrams and Appendix B for Blade configurations.

The Switchboard Meter offers two supported Z-Based forms, 9Z and 36Z (see Chapter 12).

NOTE: Form 45S replaces Form 5S and may also be used in 4-wire Delta circuits.

Table 1: Nexus® 1262/1272 Meter Forms

Form	Hookup
9S	3E Wye or Delta
36S	2 1/2E Wye
45S	2E or 4W Delta

NOTE: See Section 2.6 for Rated Voltages.

2.5: Nexus® 1262/1272 Meter Accuracy

Table 2: Nexus® 1262/1272 Meter Accuracy

Value	Accuracy
Voltage	0.02%
Current	0.05%
Frequency	0.001Hz
kW	0.06%
kWh@1.0PF	0.06%
kWh@0.5PF	0.10%
kVAR	0.10%
kVA	0.10%
PF	0.10%

2.6: Nexus® 1262/1272 Meter Specifications Overview

Sense Inputs

Current (AC)

- Transformer (CT) rated
- Two or three current inputs depending on Form (Ia, Ib, Ic)
- Class 2 - 1A nominal, burden 0.000312VA@2.5A
- Class 10, 20 - 5A nominal, burden 0.0125VA@25A
- 0.1% of nominal pick-up current
- 120% over-range of Meter Class
- Current surge withstand (at 23^{o} C): 100 Amps for 10 seconds, 300 Amps for 3 seconds, 500 Amps for 1 second
- The current inputs are only to be connected to external current transformers.

Voltage (AC)

- Blade powered unit, standard Voltage (Option S): 480V max Phase to Reference (Va, Vb, Vc, to VRef), burden total 12V max (including power supply); 600V max Phase to Phase (Va to Vb, Vb to Vc, Vc to Va)
- Blade powered unit, low Voltage (Option LV): 69V max Phase to Reference (Va, Vb, Vc, to VRef), burden total 12V max (including power supply); 120V between Va, Vb, Vc inputs
- Externally powered units (Options SE, DE): 480V max Phase to Reference (Va, Vb, Vc, to VRef), burden 0.33VA@576V; 600V max between Va, Vb, Vc inputs
- Input Impedance: 1Mohm/phase
- 20% over range of rated Voltage
- 2V pickup Voltage

External Power Supply Options

- Standard external (Option SE): (102 to 276) Vac @50/60Hz, 12VAmax
- Low Voltage external (Option DE): (18 to 60)Vdc, Burden 9W max
- Separate power cord
- Switchboard meter is always separately powered (option SE or DE)

Isolation

- All inputs and outputs isolated to 2500 Volts
- Com Ports isolated from each other to 1000 Volts

Sensing

- Accu-Measure™ Technology
- 16-bit A/D Inputs
- True RMS

- 8-Channel Sample and Hold

Memory

- All meter setup parameters, measurements and logs contained in nonvolatile RAM

Standard Communications

- LCD display
- ANSI Type 2 Optical port
- Two RS485 serial ports
- Modbus RTU, Modbus ASCII and DNP 3.0 protocols
- Data Speeds of up to 115200 bps
- Eight High-Speed Input channels

Optional Communications

- INP2: 56k Modem with dial-out capabilities
- INP200: Internal 10/100BaseT Ethernet with Total Web Solutions
- INP202: Ethernet (INP200) / Modem (INP2) Combo card
- Modbus TCP and DNP LAN/WAN

Internal 8-Channel Digital Inputs

- Type: Self-excited, for dry contacts only
- Wetting Voltage: 12Vdc typical

Internal 4-Channel KYZ Outputs

- Type: Form A or C
- On Resistance: 23-35Ω
- Peak Voltage: 350Vdc

- Continuous Load Current: 120mA
- Peak Load Current: 350mA (10ms)
- Off-State Leakage Current @350Vdc: 1:μA
- Opto Isolation: 3750V rms (60 Hz, 1 min)

Clock Timing

- IRIG-B input for synchronizing to external GPS clock signal - accuracy better than 1msec per month
- Line Frequency Clock Synchronization - accuracy better than 1 second per month
- Internal Clock Crystal - accuracy better than 2 minutes per month

Environmental (Temperature Specifications to Indirect Light)

- Operating Temperature: (-40 to +85)°C
- Display Operating Temperature: (-20 to +60)°C
- Humidity: 95% non-condensing
- Storage Temperature: (-40 to +85)°C
- Raintight Lexan Cover (Socket meter)

NOTE: At temperatures above 60° C the display may turn black. The display should return to normal once the temperature has cooled. If the meter is exhibiting a heating issue that causes the display to turn black, try shielding the meter from direct sunlight or otherwise provide some cooling effect to the meter.

Security

- A hardware lock secures meter settings.
- Two 10-character passwords are configurable: one password controls access to read meter digitally; a separate password controls access to meter programming.
- An additional 8 level password sequence is available by user configuration.

Internal Battery

- Panasonic BR3032 3V Lithium Battery (or equivalent) maintains NVRAM and time during outages.

Modem Battery

- 3V Lithium Battery with custom leads and velcro mounting maintains Dial-Back feature during outages. Call factory for replacement battery - the part # is BAT1.

IRIG-B Port Impedance

- 1.8mA @ 5V

Compliance

- ANSI C12.20 Class 0.2 (0.2% Accuracy)
- ANSI C37.90.1 (Surge Withstand)
- ANSI C62.41 (Surge Immunity)
- ANSI C12.18 (Optical Port)
- IEC/CISPR 14-1 (Continuous EM Disturbance)
- IEC801-2 (Electrostatic Discharge)
- IEC801-3 (Radiated EM Immunity)
- IEC801-4 (EFT)
- IEC687 (Voltage Dips and Interruptions)
- IEC60687 (Class 0.2% Accuracy)
- IEC 62053-22 (0.2% Accuracy)
- IEC62052-11 (General Requirements; Mechanical Properties; Climactic Influences)

2.7: Nexus® 1262/1272 Meter Logging Specifications

Model	Memory	Historical Log 1*	Historical Log 2*	CBEMA / ITIC**	Event Log **	Wave-form Log***	Flicker Log**	Output Log**	Input Log **	System Events**
1272	Standard	85 Days	133 Days	512	1024	63	1536	256	1024	1024
1272	Advanced	555 Days	133 Days	512	1024	95	5120	256	1024	1024
1262	Standard	69 Days	32 Days	N/A	512	N/A	N/A	512	1024	1024
1262	Advanced	480 Days	133 Days	N/A	512	N/A	N/A	512	1024	1024

*Assumes logs store 4 scaled energy readings every 15 minutes.

**Number of events recorded (assumes 14 parameters monitored).

***Number of waveform records. Each record may be from 8 to 64 cycles in duration, depending upon meter setup.

2.8: DNP V3.00 Level 2

Nexus® 1262 and 1272 meters support DNP V3.00 Level 2

DNP Level 2 Features

- Up to 136 measurements (64 Binary Inputs, 32 Binary Counters, 64 Anabg Inputs) can be mapped to DNP Static Points (over 3000) in the customizable DNP Point Map.
- Up to 16 Relays and 8 Resets can be controlled through DNP Level 2.
- Report-by-Exception Processing (DNP Events) Deadbands can be set on a per-point basis.
- Available Freeze commands are Freeze, Freeze/No-Ack, Freeze with Time, and Freeze with Time/No-Ack.
- Freeze with Time commands enable the Nexus® meter to have internal time-driven Frozen and Frozen Event data. When the meter receives the time and interval, the data is created.

For complete details, download the appropriate DNP User Manual from our website at www.electroind.com.

This page intentionally left blank.

3: Operating Instructions

3.1: Nameplate Information

The Nexus® 1262/1272 Socket meter has its operating information represented on the nameplate, which is located on the face of the meter (see figure below). Serial and Model numbers are on the Options label (see next page).

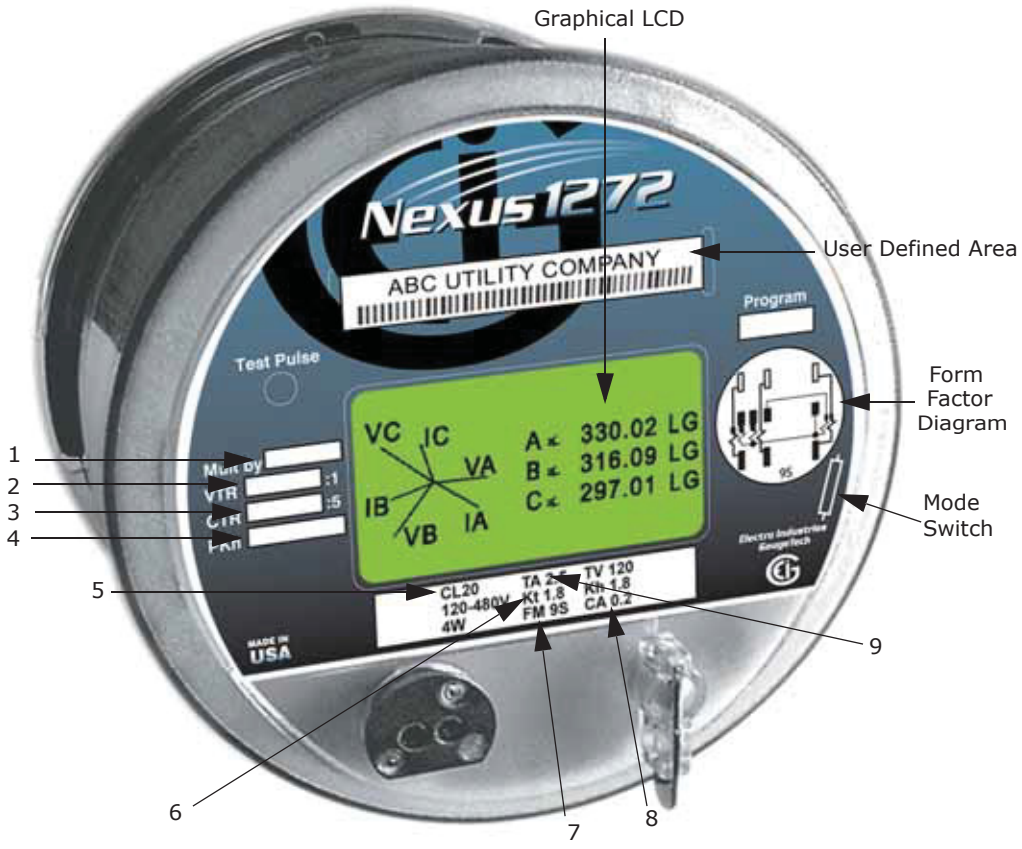


Figure 3.1: Meter Showing Faceplate Elements

The numbers in the figure represent:

1. Multiply by Constant

2. Voltage Transformer Ratio (PT Ratio)

3. Current Transformer Ratio (see Glossary)

4. Primary Watt-hour constant

5. Current class

6. Watt-hour test constant

7. ANSI C12.20 Form Number

8. ANSI C12.20 Accuracy Class

9. Test Amperes

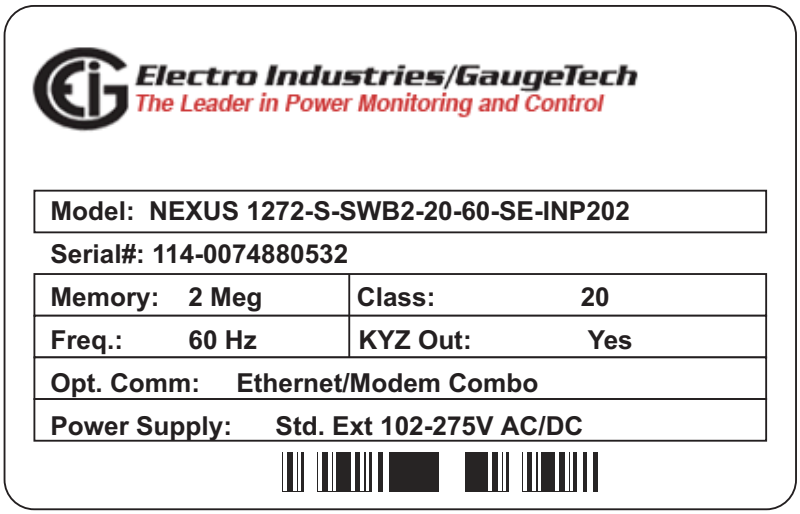


Figure 3.2: Meter Options Label

The Options Label is located on the outside of the internal shroud. It is printed specifically for each meter and shows the ordered options that are included in the meter. An example of a typical label is shown above. Below is a list of options available for the meter:

Memory (1272):

S (Standard) 2M of RAM

A (Advanced) 4M of RAM

Memory (1262):

S (Standard) 512K of RAM

A (Advanced) 2M of RAM

Communication Options:

INP2 - Dial Out Option

INP200 - Ethernet 10/100BaseT

INP202 - Ethernet/Modem Combination

Case Style:

SWB2 - Switchboard

45S, 9S, 36S - Socket meter Forms

9A - Socket meter in A-Base

Power Supply:

SE - Std. Ext 102-275V AC/DC

S - Std. Blade Powered

DE - DC Ext 18-60 VDC

LV - 69 VAC Blade Powered

EIG Number - Model Number plus Option Numbers (Example below):

Model	Memory	Form	Freq	Power Supply	I/O	Communication
1272	A	9S	60Hz	S	4PO1	INP200

3.2: Basic Operation

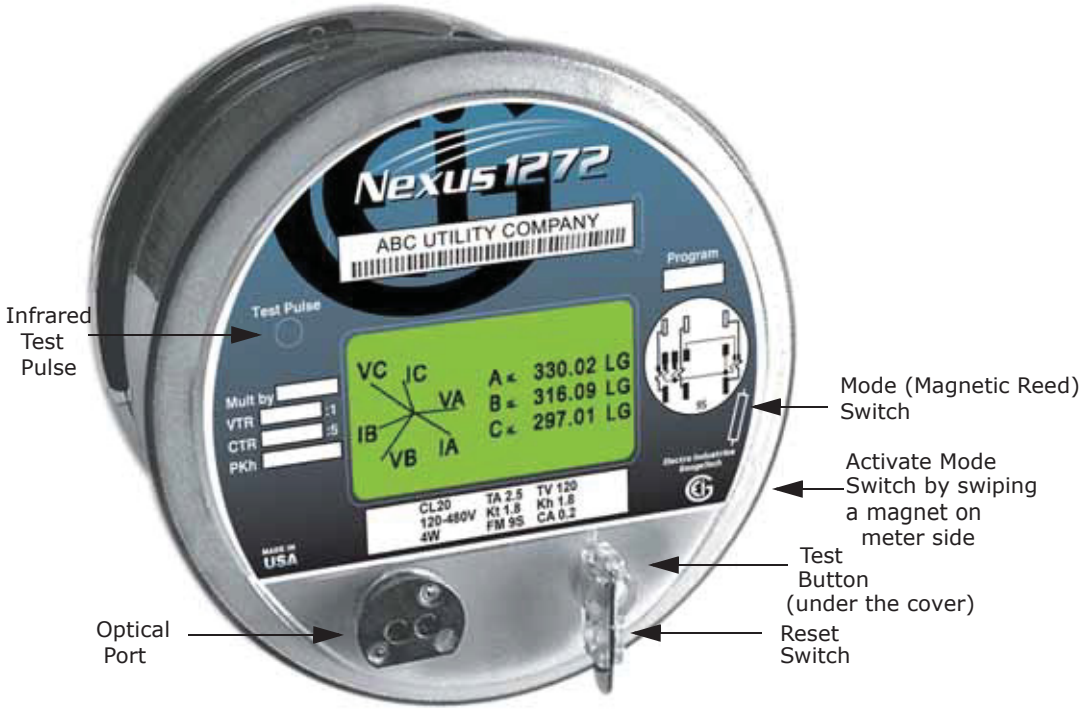


Figure 3.3: Meter Showing Switches and Indicators

Switches and Indicators

- There are two switches accessible from outside the meter cover:

    1. The **Mode** Switch (also called a Magnetic Reed Switch) is used to switch from Normal Mode to Circuit Diagnostic Mode or Time of Use Mode.

    2. The **Reset** Switch is used to reset Demand.

- A third switch, the **Test** Button, is accessible only when the cover has been removed. The Test Button switches the meter from one of the operational modes to Test Mode and back to Normal Mode. The Test Button is also used to access Display Adjustments Mode during Power-up Mode.

Optical Port

The Optical port is located on the lower left side of the meter face. With the Optical port you can program the meter with Communicator EXT software using an A7Z or A9U Communication Interface (or other ANSI C12.13 Type II magnetic optical communications coupler) and an RS232 cable (A7Z) or a USB cable (A9U) to a PC.

Test Pulse

An infrared Test pulse is located on the upper left side of the face. Energy pulsing applications can be configured using Communicator EXT software.

Phase Indicator

A Phase indicator is located on the lower right side of the face. "ABC" stays illuminated if all three phases of Voltage and current are present. "ACB" indicates reversed phase sequence. The indicator blinks A, B or C if one phase is not present. If no phases are present, the meter turns off (unless you have an Aux pigtail connected to a power source).

3.3: LCD Display Information

The Nexus® 1262/1272 meter has a graphical back-lit FSTN LCD programmable display with extended temperature Voltage compensation. The display lets you view Energy data and gather circuit diagnostic data such as Voltage, current, harmonics and phasor information.

You use Communicator EXT software to program the display. The display has three View modes to which you assign screens. This lets you determine what data is displayed and in what order. View mode 1 is the primary mode; the other modes automatically return to View mode 1 after a user-set amount of inactivity. Set the time through Communicator EXT (see Section 3.5 instructions for the Miscellaneous tab). There is also a Test mode and a Select Compensation screen.

Mode Details

- Access View mode 2 and View mode 3 by swiping the Mode Switch with a magnet (see Figure 3.3). Access Test mode by removing the cover (POWER MUST BE OFF), powering up the meter and pushing the Test Button at any time. See the Navigation map in Section 3.4 for display mode details.

- Test mode automatically returns to View mode 1 after an amount of time since the last user action with no energy accumulation (or) an amount of time since the last user action plus the Demand interval with energy accumulation. The values for the amount of time since the last user action are set through Communicator EXT (see Section 3.5 instructions for the Miscellaneous tab).

Display Configurator

A Nexus® meter with the appropriate firmware (User Programmable LCD Display Run Time Firmware version 100, LCD Display Boot version 30, Base meter's COM Run Time 624; or higher - post-November, 2010) gives you the Display Configurator, which lets you assign up to 75 LCD display screens across the three View modes. These screens can be made of any combination of pre-defined screens (see Section 3.6.1), pre-defined screens with some customization, and fully customized screens with any of the meter's measured readings and numeric calculations, such as scaling. The Display Configurator's flexibility lets you match the display screens to any application needs you have. Refer to Section 3.5 for programming details.

Base Programmable Display

Nexus® meters with an LCD Display Run Time Firmware version of less than 100 (pre-November, 2010) do not have the Display Configurator. For these meters you can assign up to 16 pre-defined screens per View mode. Refer to Section 3.6 for programming details.

NOTE: See Section 3.3.1 for instructions on finding your display's firmware version.

Low Battery

Lo Batt - NVRam (Internal Battery) or Lo Batt - Modem (Modem Battery) flashes on the screen every 10-15 seconds when the Internal (or Modem) Battery is running low or when it is not "clicked" into place properly. See installation instructions in Section 6.2.

Test Mode

- Wh Test - Same as kWh screen, except in Wh instead of kWh
- VARh Test - Same as kVAR screen, except in VARh (Quadrants)
- VAh Test - Same as kVAh screen, except in VAh (Quadrants)
- Watt Rolling Demand Test (Delivered and Received)
- Watt Block Demand Test (Delivered and Received)

Initial Display Screens

The Nexus® 1262/1272 meter ships with initial display screens, which scroll on the display as soon as you power up the meter. The initial display screens are a sampling of the pre-defined screens. Typical initial display screens include:

- Meter Data, including Boot, Run, DSP Boot, DSP Run, Serial Number, Protect Enabled, Baud
- Wh Delivered
- Wh Received
- kVARh per Quadrant
- kVAh per Quadrant
- Rolling W Demand Delivered
- Rolling W Demand Received
- Block W Demand Delivered
- Block W Demand Received
- W Demand Last Reset
- Cumulative W Demand

Backlight

The Backlight cannot be set to stay on indefinitely. It turns off after a programmed interval: one hour is the maximum setting. If the backlight times out and is off, swipe the Mode Switch once to turn the backlight on and redirect the screen.

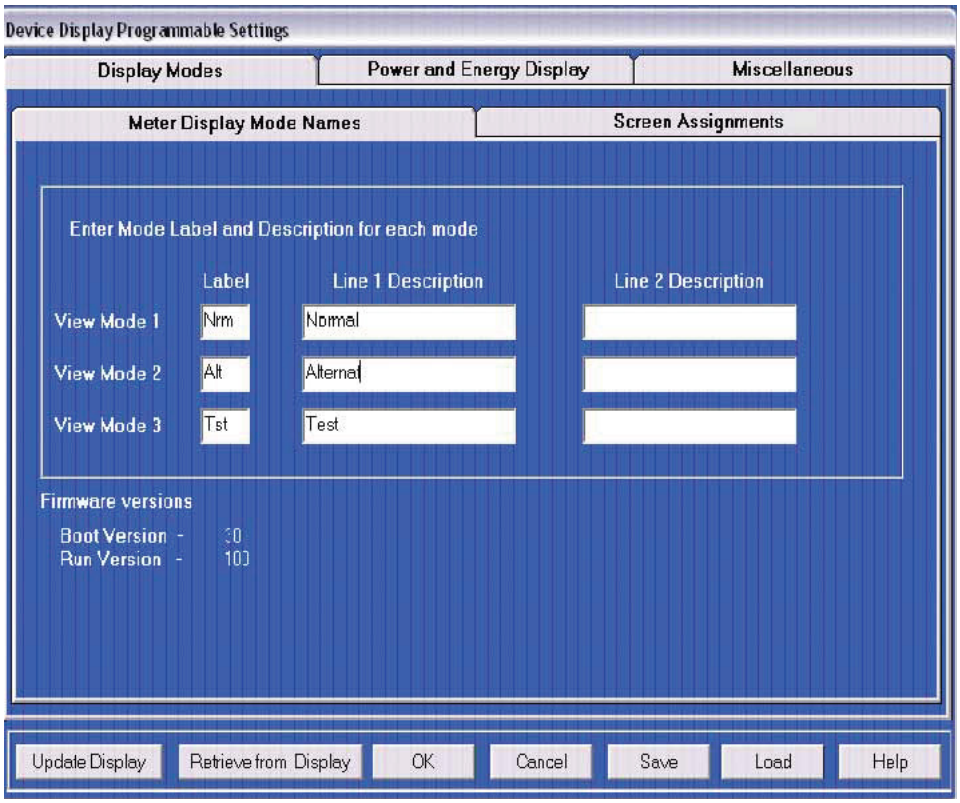
3.3.1: Finding Your Display's Firmware Versions

To find your LCD display's firmware versions, follow these steps:

1. Connect to the meter though Communicator EXT software.

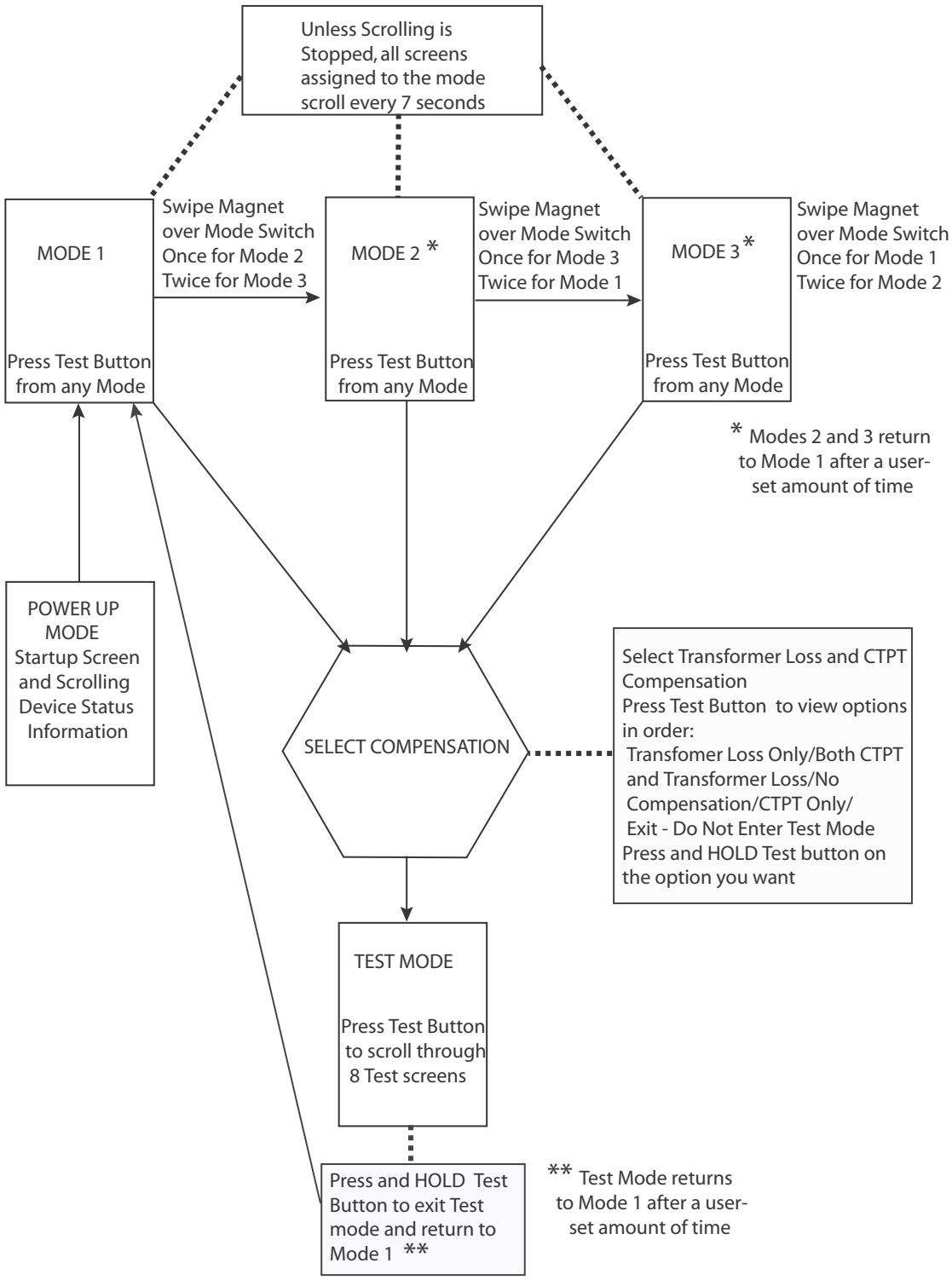
2. Click the **Profile** icon in the Title bar.

3. Click **Revenue and Energy Settings>Display Configuration** to open the Device Display Programable Settings screen, shown below.



4. The LCD display's firmware versions are shown in the bottom left portion of the screen. If the Boot version is 30 or higher and the Run version is 100 or higher, follow the instructions in Section 3.5. If the Boot and Run versions are less than 30/100, follow the instructions in Section 3.6.

3.4: Nexus 1262/1272 Programmable Display Navigation Map


Unless Scrolling is Stopped, all screens assigned to the mode scroll every 7 seconds
MODE 1
Press Test Button from any Mode
Swipe Magnet over Mode Switch Once for Mode 2 Twice for Mode 3
MODE 2 *
Press Test Button from any Mode
Swipe Magnet over Mode Switch Once for Mode 3 Twice for Mode 1
MODE 3 *
Press Test Button from any Mode
Swipe Magnet over Mode Switch Once for Mode 1 Twice for Mode 2
* Modes 2 and 3 return to Mode 1 after a user-set amount of time
POWER UP MODE Startup Screen and Scrolling Device Status Information
SELECT COMPENSATION
Select Transformer Loss and CTPT Compensation
Press Test Button to view options in order:
Transfomer Loss Only/Both CTPT and Transformer Loss/No Compensation/CTPT Only/
Exit - Do Not Enter Test Mode
Press and HOLD Test button on the option you want
TEST MODE
Press Test Button to scroll through 8 Test screens
Press and HOLD Test Button to exit Test mode and return to Mode 1 **
** Test Mode returns to Mode 1 after a user-set amount of time

3.5: Using the Display Configurator

The Nexus® 1262/1272 meter with appropriate firmware (User Programmable LCD Display Run Time Firmware version 100, LCD Display Boot version 30, Base meter's COM Run Time 624; or higher) gives you the Display Configurator. This feature lets you customize the meter's LCD screens to display any measured readings. The Display Configurator features three View modes (see Section 3.3) and has memory for up to 75 screens, distributed however you want among the three View modes.

The flexibility of the Display Configurator allows you to customize the LCD display for any application. Additional features of the Display Configurator are as follows:

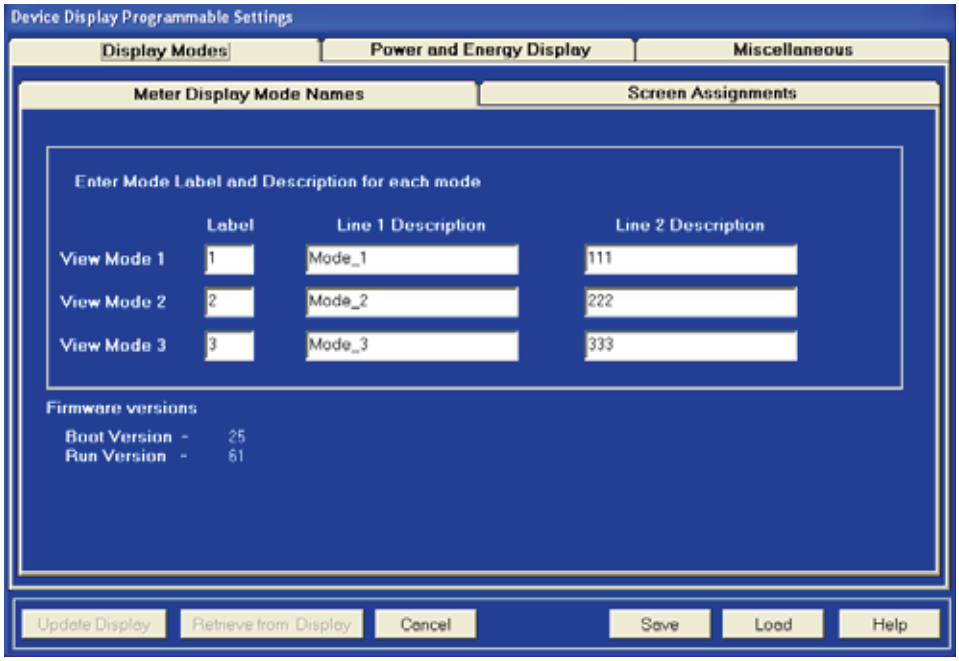
- You can add screen numbers and/or labels (titles).
- You can add scaling and multiplier factors to the screen data.
- You can use the screens to view data from pulse inputs, such as water, gas, steam, etc.
- You can use a combination of pre-defined and customized displays. See Section 3.6.1 for a list of the pre-defined displays.

IMPORTANT! You use the Nexus® 1262/1272 meter's Modbus map to identify the data you want to display in a customized display screen. The Modbus map for the Nexus® 1262/1272 meter is contained in the *Modus Protocol and Register Map for Nexus® 1252/1262/1272 Meters*. The manual can be downloaded from EIG's website: www.electroind.com/pdf/modbus2.pdf.

To access the Display Configurator's programming screens

1. Connect to the meter through Communicator EXT.
2. Click the **Profile** icon to open the Device Profile screen.
3. Click the plus sign (+) next to Revenue and Energy Settings.

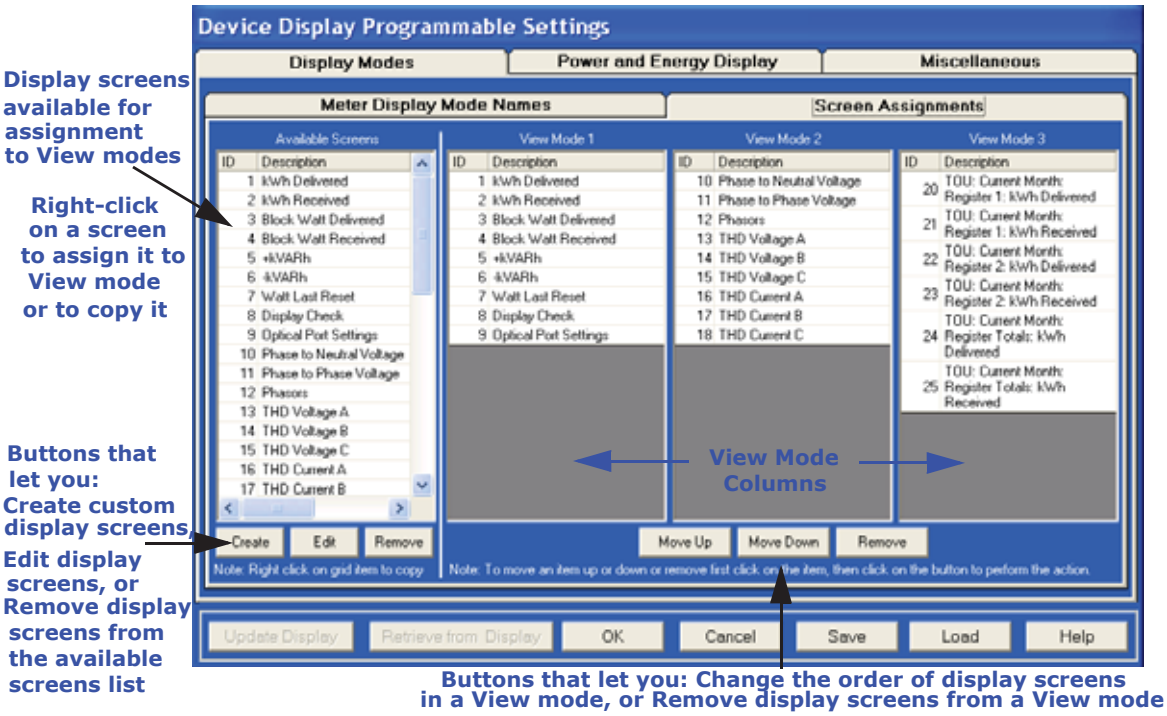
4. Double-click **Display Configuration**. You will see the screen show below. The first tab is Meter Display Mode Names, which lets you assign labels and descriptions to the three View modes.



a. Enter a three-letter label for each of the three View modes.

b. Enter a description for each mode using the Line 1 and Line 2 Description fields.

5. Click the Screen Assignments tab. You will see the screen shown on the next page.


Device Display Programmable Settings
Display Modes
Power and Energy Display
Miscellaneous
Meter Display Mode Names
Screen Assignments
Available Screens
View Mode 1
View Mode 2
View Mode 3
Create
Edit
Remove
Move Up
Move Down
Remove
Update Display
Retrieve from Display
OK
Cancel
Save
Load
Help
Display screens available for assignment to View modes
Right-click on a screen to assign it to View mode or to copy it
Buttons that let you: Create custom display screens, Edit display screens, or Remove display screens from the available screens list
View Mode Columns
Buttons that let you: Change the order of display screens in a View mode, or Remove display screens from a View mode

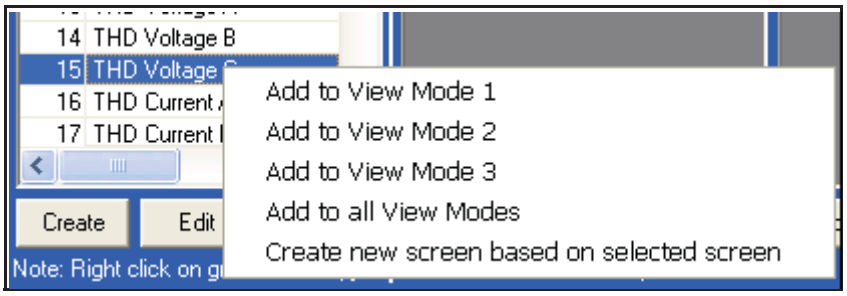
6. Using the buttons on the bottom of the screen you can:

- Retrieve display settings from the connected meter by clicking **Retrieve from Display.**
- Update the connected meter's display settings by clicking **Update Display**. The meter reboots and you see a message on the PC screen: Device LCD Display Programmable Settings Updated.
- Save any changes you have made to display settings by clicking **Save**.
- Load a previously saved LCD display file by clicking **Load** and select the file you want to load into this screen (it is a .nds2 file).
- Return to the previous screen without saving any changes by clicking **Cancel**.
- View online instructions for using this screen by clicking **Help**.

The leftmost column lists all of the Available display screens. Before you've used the Display Configurator, you will only see the pre-defined display screens in the list. Once you have created customized screens, you will see those in the list as well.

The other three columns list the display screens that are assigned to each of the three View modes. Use the scroll bars to display all of the items in the columns.

a. To assign one of the screens to a View mode or to create a new screen based on it, click on the screen in the list and right-click. You will see the pop-up menu shown below.



- To add the screen to one of the modes, or to all modes, click on that item in the menu.

- To create a new screen based on the screen, click on the last item in the menu (see Step e).

b. To change the position of screens in one of the View modes, or to remove the screen from the mode, click on the screen in the View mode column and then either:

- Click **Move Up** or **Move Down** to change the position of the screen within that View mode. The position of the screens determines their scrolling order.

- Click **Remove** to remove the screen from that View mode.

c. To create a custom display screen, click **Create** in the Available Screens column. Continue to "**Creating a Custom Display Screen**" on the next page.

NOTE: to Edit a custom screen, click on the screen in the Available Screens list and then click **Edit**. Then use the instructions in "**Creating a Custom Display Screen**" on the next page to modify the screen.

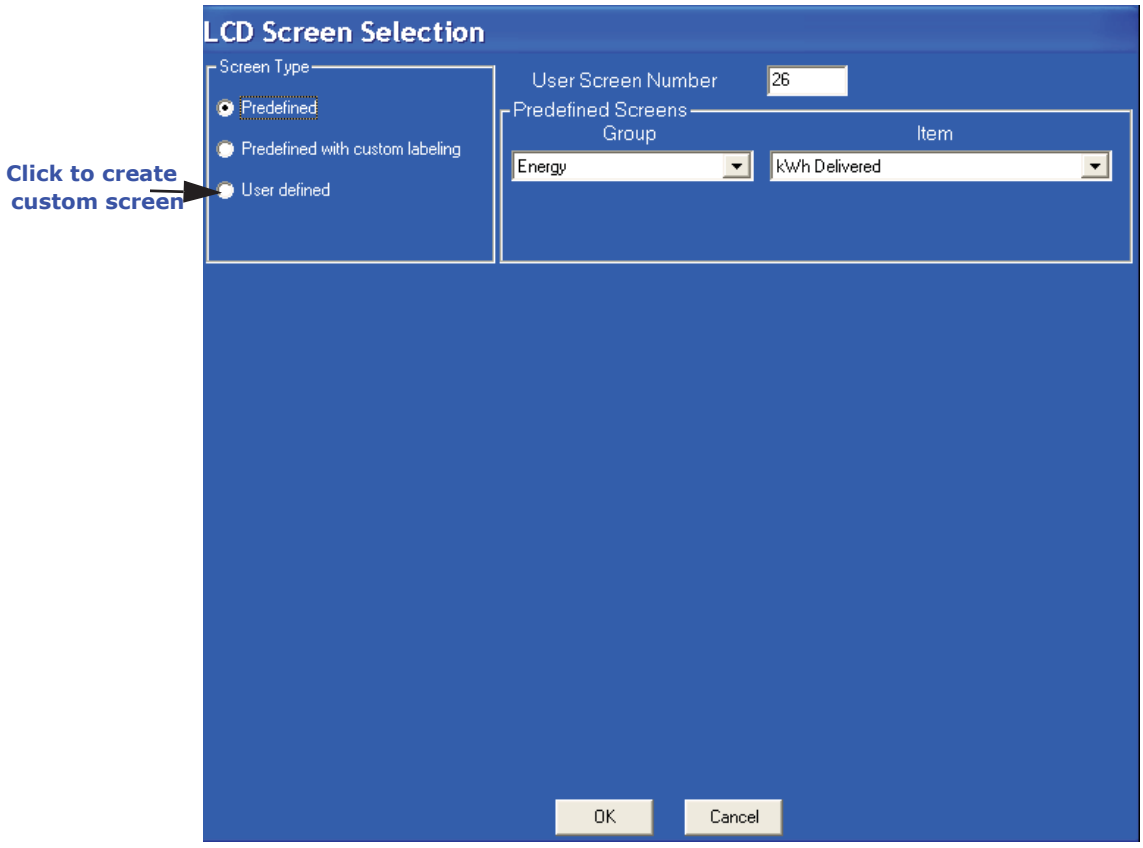
d. To edit a pre-defined screen, click on the screen in the Available Screens column list and then click **Edit**. Continue to "**Editing a Pre-defined Display Screen**" on page 3-22.

e. To create a new screen based on an existing screen, highlight the screen in the Available Screens column list, right-click and select **Create New Screen Based on Selected Screen**. If you are making a custom screen, follow the instructions below. If you are just changing the screen number or label, follow the instructions in "**Editing a Pre-defined Display Screen**" on page 3-22.

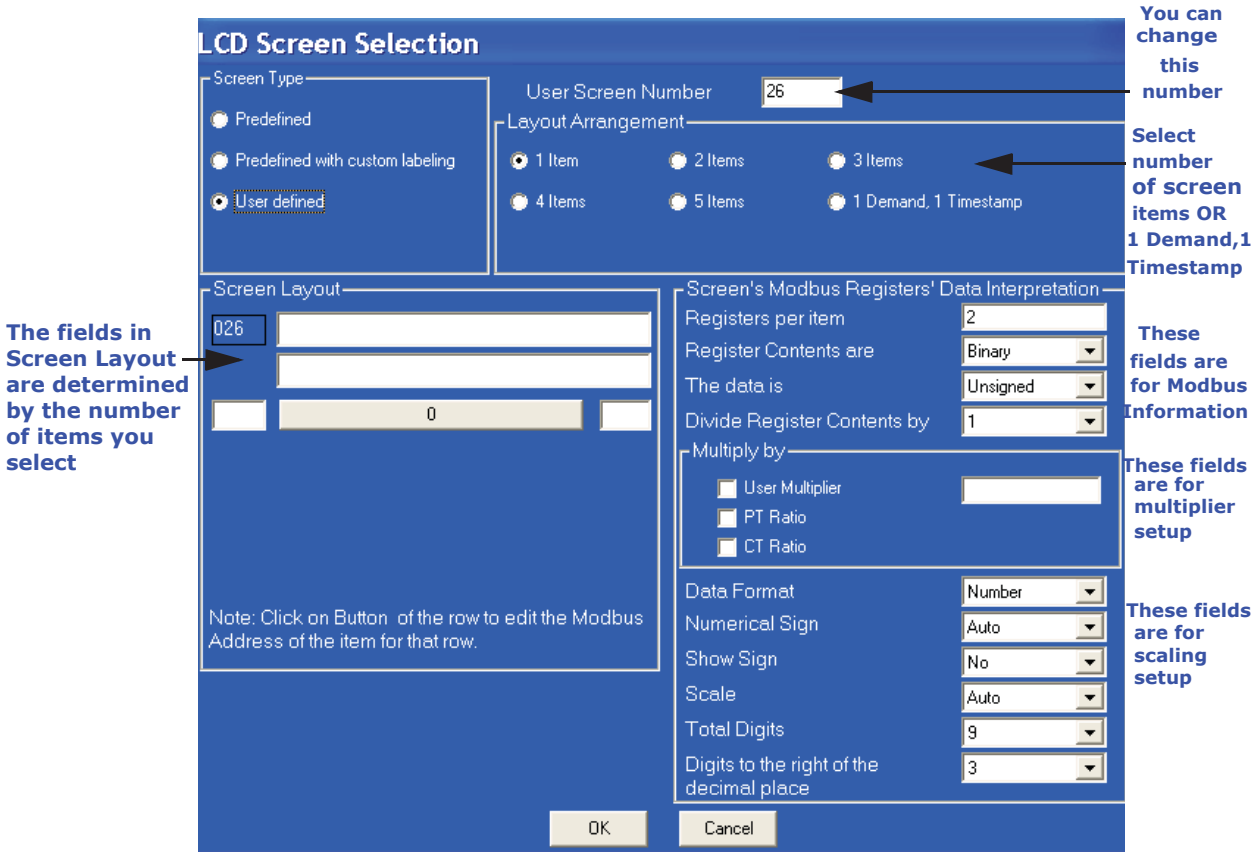
f. To remove a screen from the list of available screens, click on the screen in the Available Screens column list and then click **Remove**. The screen is no longer displayed in the list of available screens, and cannot be assigned to any View mode. It is also removed from any View modes it has already been assigned to.

Creating a Custom Display Screen

After you click the **Create** button in the Available screens list, you will see the LCD Screen Selection screen, shown below.



1. Click the **User defined** button in the Screen Type box. The screen changes to allow you to set up the new Display screen.



2. You can change the number shown in the User Screen Number field. This field accepts any number up to three digits in length. Use numbers between 1 and 999 f you want the number to display on the LCD display screen; use numbers between 1000 and 1999 if you don't want the number to display. **NOTE:** The Harmonics, Phasors, and Line Segment screens never display their number on the LCD display screen.

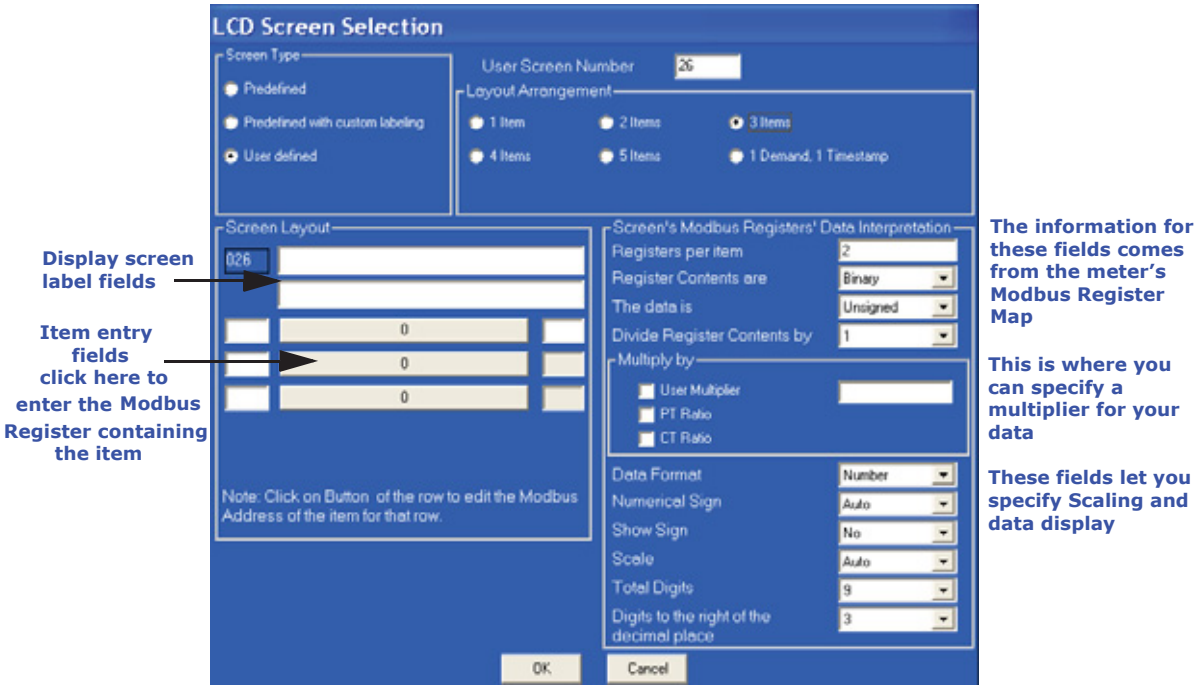
3. Use the Layout Arrangement field to choose what fields you want the LCD screen to display. Choose either:

   a. The number of items you want the LCD screen to display: click one of the **Item** buttons.

   b. Display Demand and Timestamp fields: click the **1 Demand, 1 Timestamp** button.

After you make your selection, the left side of the screen changes to display entry fields for the Item(s) or Demand and Time Stamp information. See the example screens below.

Custom Screen with 3 Item Fields



Display screen label fields

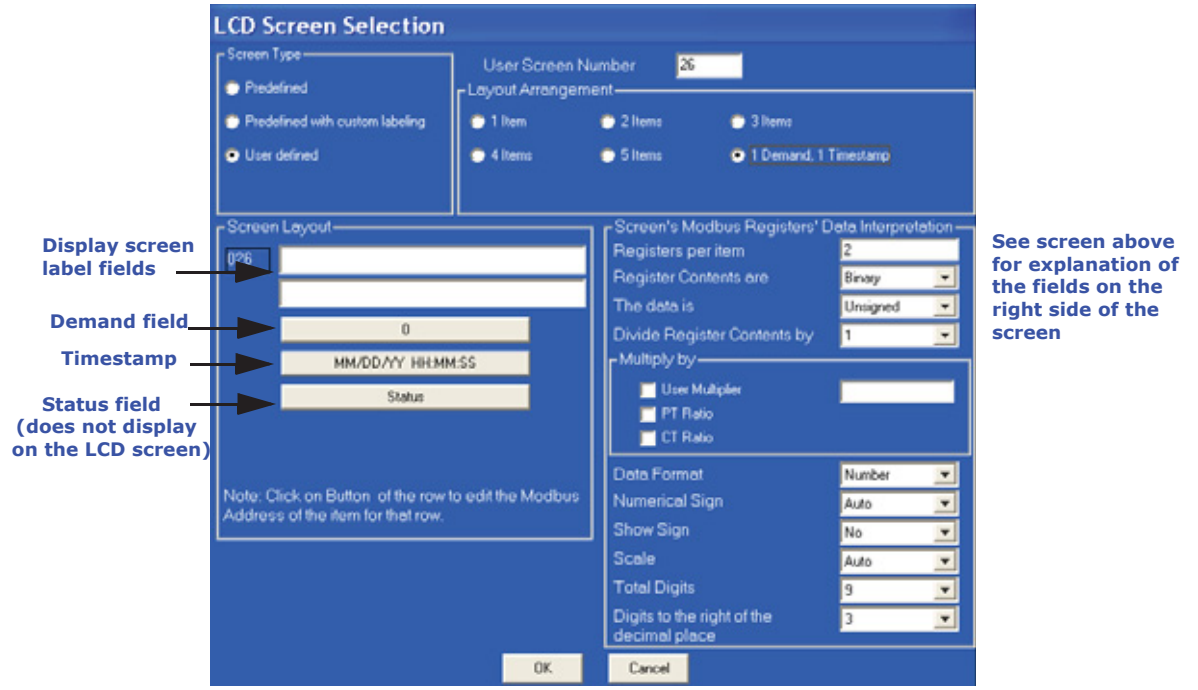
Item entry fields click here to enter the Modbus Register containing the item

The information for these fields comes from the meter's Modbus Register Map

This is where you can specify a multiplier for your data

These fields let you specify Scaling and data display

Custom Screen with 1 Demand, 1 Timestamp Fields



Display screen label fields

Demand field

Timestamp

Status field (does not display on the LCD screen)

See screen above for explanation of the fields on the right side of the screen

The top field in the Screen Layout section is for the display screen label (Title). Depending on the number of items you select, you will have between 0 to 2 lines for a screen label:

- If you selected 1-3 items or 1 Demand, 1 Timestamp, you will have two entry lines.
- If you selected 4 items you will have one entry line.
- If you selected 5 items, you will not have any entry fields for a display screen label (there won't be room on the screen for a label).

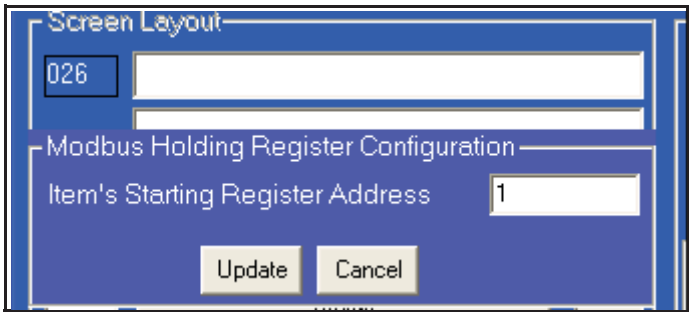
The Item entry fields allow you to specify the data you want to display on the LCD screen. You can also enter a prefix (optional) for each line item and a suffix (optional) for all of the items on the display screen.

Example: A screen containing phase to phase Voltages might have a single title (Volts P-P), 3 lines of data with prefixes (Vab, Vbc, Vca), and the same suffix (MV) on all 3 lines.

The 1 Demand, 1 Timestamp entry fields allow you to specify the Demand, the timestamp, and an optional status register. The status register is not displayed on the LCD screen.

4. To enter an item:

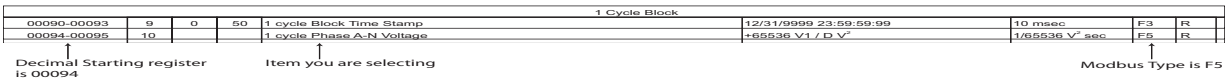
   a. Click on the Item label box. Fields that open underneath the item allow you to enter the starting value of the Modbus Register containing the data for the item. Use the Decimal value of the register. See the screen below. Refer to the *Nexus® 1252/1262/1272 Meter Modbus Manual* for the 1262/1272 meter's Modbus Register Map. The manual can be downloaded from EIG's website: www.electroind.com/pdf/modbus2.pdf.



IMPORTANT! All of the data items you select must be the same Modbus type, for example F3. The Modbus type is listed in the Modbus map. See the Example below.

Example:

To select 1 Cycle Phase A-N Voltage, find the starting register for the field in the Modbus manual. See the figure below:


1 Cycle Block
00090-00093 9 0 50 1 cycle Block Time Stamp 12/31/9999 23:59:59:99 10 msec F3 R
00094-00095 10 1 cycle Phase A-N Voltage +65536 V1 / D V² 1/65536 V² sec F5 R
Decimal Starting register is 00094
Item you are selecting
Modbus Type is F5

b. Click **Update** to save the item's starting register address.

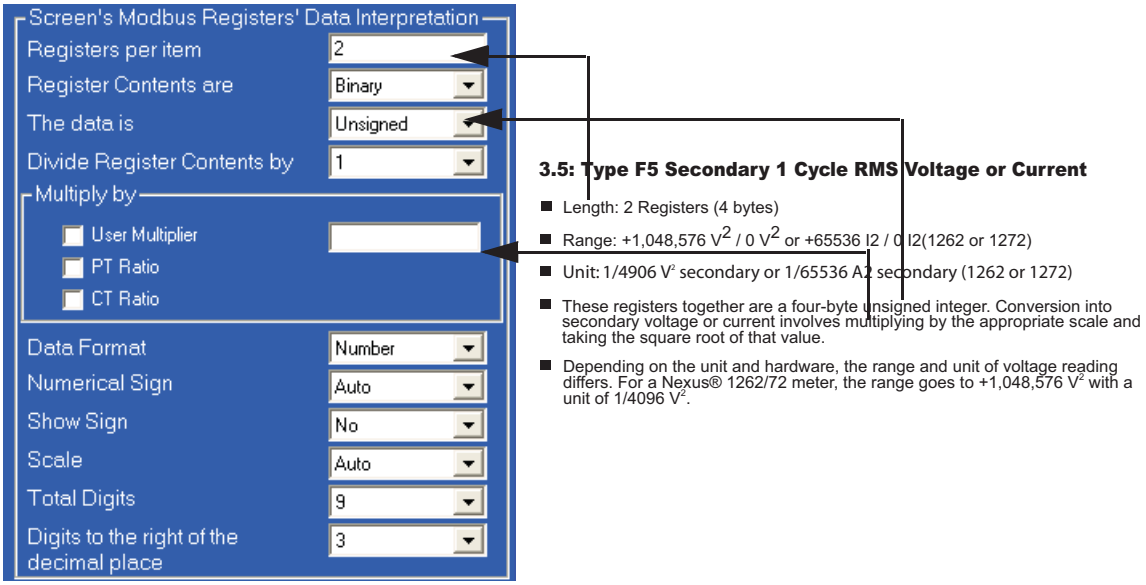
c. Enter any additional items in the same way.

d. When you finish entering items, use the entry fields in the right portion of the screen to enter details for the items' Modbus type, and to enter scaling, multiplier, and data display settings. The Modbus type information is found in Chapter 3 of the *Nexus® 1252/1262/1272 Meter Modbus Manual*. See the following example.

Example:

The item in the example above was Modbus type F5. Any additional items must be the same Modbus type. Type 5 is described in Chapter 3, page 3-3 of the 1262/1272 Meter's Modbus manual, as shown in the excerpt that follows.

Use the Modbus type information as shown below.


Screen's Modbus Registers' Data Interpretation
Registers per item
2
Register Contents are
Binary
The data is
Unsigned
Divide Register Contents by
1
Multiply by
User Multiplier
PT Ratio
CT Ratio
Data Format
Number
Numerical Sign
Auto
Show Sign
No
Scale
Auto
Total Digits
9
Digits to the right of the decimal place
3
3.5: Type F5 Secondary 1 Cycle RMS Voltage or Current
Length: 2 Registers (4 bytes)
Range: +1,048,576 V2 / 0 V2 or +65536 I2 / 0 I2(1262 or 1272)
Unit: 1/4906 V2 secondary or 1/65536 A2 secondary (1262 or 1272)
These registers together are a four-byte unsigned integer. Conversion into secondary voltage or current involves multiplying by the appropriate scale and taking the square root of that value.
Depending on the unit and hardware, the range and unit of voltage reading differs. For a Nexus® 1262/72 meter, the range goes to +1,048,576 V2 with a unit of 1/4096 V2.

In the example above, you would find the number of registers per item, the fact that the data is unsigned, and scaling information from the Modbus type information.

The fields on the left, underneath the Multiply by fields, let you set up how the data will be displayed, for example, specifying if the data is a number or some other value; whether you want the sign to display for signed data; whether you want the data scaled, the number of digits and decimal places in the field. Click the pull-down menus to see alternate choices for the fields. The entries you make affect all of the items on the screen. The table that follows shows the fields and the valid entries for them.

Entry fields	Possible entries
Registers per item	1 - 8
Register contents	Binary, BCD, Text, Scaled Energy
Data	Signed, Unsigned
Divide contents by	1, 100, 65536
Multiply by	User multiplier (enter in blank field), PT Ratio, CT Ratio
Data format	Number, Text, Power factor, Time, Date, Time & Date, Status indicator
Numerical sign	Auto, Forced negative, Forced positive
Show sign	No, Yes
Scale	Auto, None, kilo (k), Mega (M), Giga (G)
Total digits	1-10
Digits to the right of the decimal place	1-8

3. Once you finish making your entries, click **OK** to return to the Screen Assignments tab. The new screen is now listed in the left-most column. Click on it and then right-click to assign it to one or all of the View modes.

4. When you finish programming the LCD display, click:

   - **Save** to save the LCD Programmable Settings to a .nds2 file.
   - **Upload** to upload the LCD Programmable Settings to the connected 1262/1272 meter.
   - **Cancel** to exit the screen **without saving any changes**.

Editing a Pre-defined Display Screen

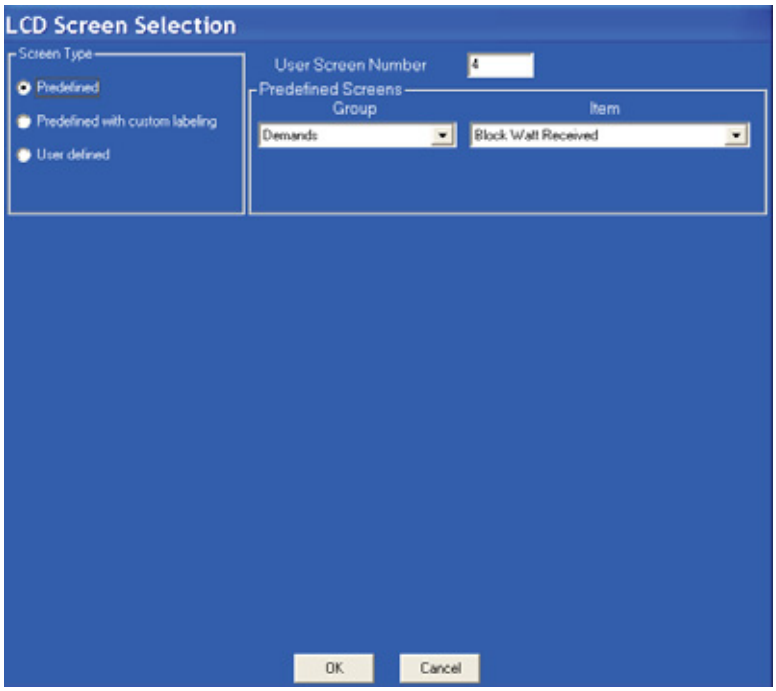
You have the following options for editing pre-defined screens:

- You can edit the screen number.
- You can edit the screen label (title).
- You can create a new screen based on the pre-defined screen, but you will still only be able to change the screen number and/or label.

NOTE: Some of the pre-defined screens cannot be customized as described above. The table below lists these pre-defined screens and tells what can be changed in them.

Pre-defined LCD Screen Number (Default Value)	Description	Editing Options
18	Phasors	None
20	VAR, PF, & Frequency	Title
21 - 26	Harmonics	Title
60	Segment check	None
64	Optical Port Settings	Title
65	Comm Ports	Title
66	Nexus Status	Title
67	Firmware Versions	Title
68	Nexus Info	Title
76 - 77	Rolling/Block Demand	Title
80 - 89	TOU Energy	Title
90 - 93	TOU Demand	Title
94-95	TOU +/-VARh	Title

1. When you click **Edit** after selecting a pre-defined screen in the Available screens list (or right-click to select **Create a new screen based on selected screen**) you see the LCD Screen Selection screen. See the example screen that follows.



2. The button at the top of the screen reflects the type of screen you are editing or copying: either Pre-defined or Pre-defined with custom labeling.

   - You can only change the screen number for a pre-defined screen (see example screen on the previous page), but if you are creating a new screen based on a pre-defined screen, you can select the pre-defined with custom labeling button to change the title as well as the number of the screen. Refer to the table on the previous page for editing limitations.

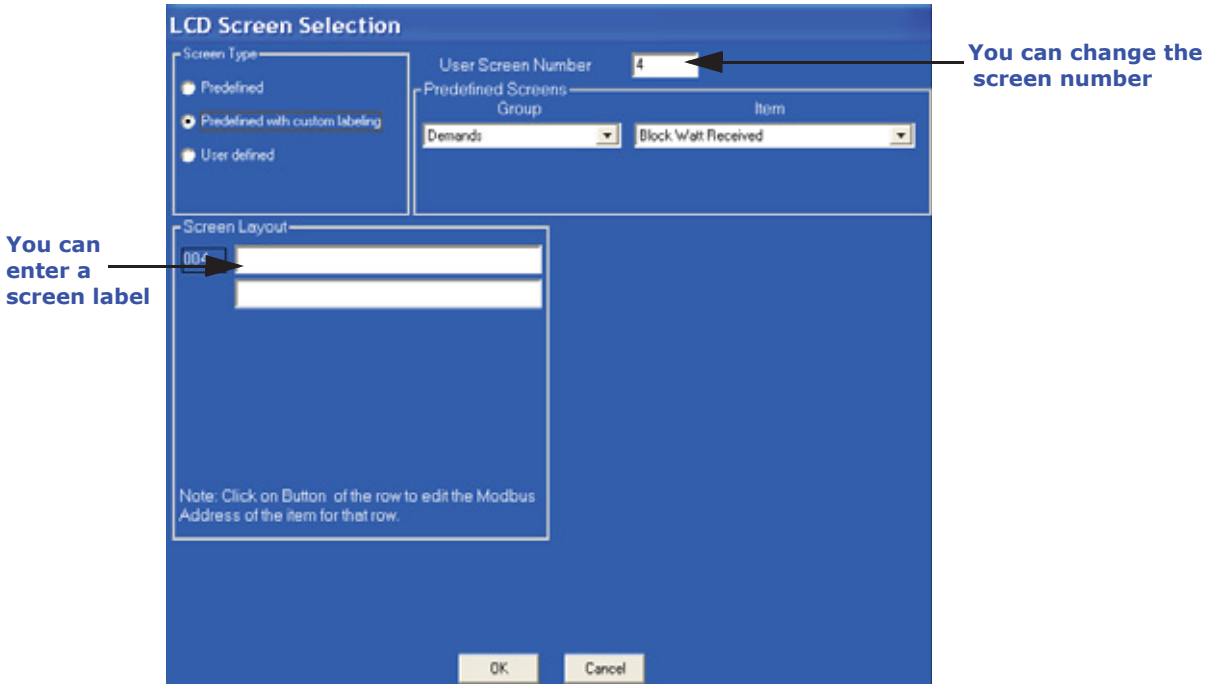
   - For a pre-defined screen with custom labeling, you can change the screen number and also the screen label. See the example screen that follows. Refer to the table on the previous page for editing limitations.

     NOTES:

     - The Screen number field is a three digit numeric field. Use numbers between 1 and 999 to display the number on the LCD display screen; use numbers between 1000 and 1999 to not display the number on the LCD display screen.

- The Harmonics, Phasors, and Line Segment screens never display their number on the LCD display screen.
- Depending on the pre-defined screen, you have between 0 - 3 lines for screen label entry. Screen labels can be up to 16 characters per line.

Below is an example of a Pre-defined with custom labeling screen.



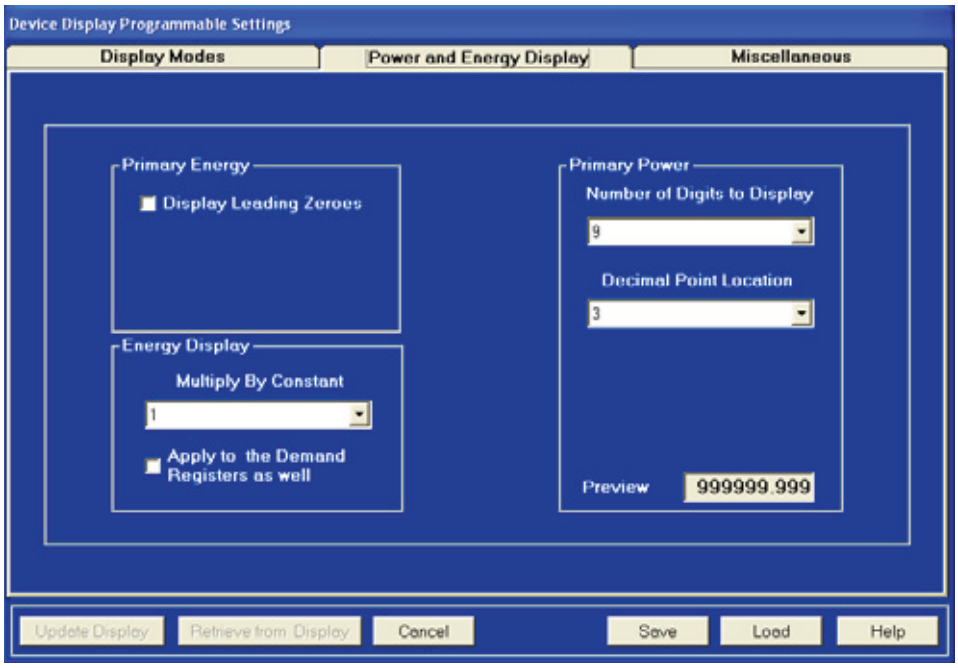
3. After you make your entries, click **OK**. You then return to the previous screen (Screen Assignments tab).

4. When you finish programming the LCD display, click:

   - **Save** to save the LCD Programmable Settings to a .nds2 file.
   - **Upload** to upload the LCD Programmable Settings to the connected meter.
   - **Cancel** to exit the screen **without saving any changes**.

Power and Energy Display Tab

1. Click the Power and Energy Display tab. You will see the screen shown below.



2. Enter settings for Power and Energy:

- Number of Digits: 4 - 9 (Primary Power)
- Decimal Point Location: 0 - 3 (Primary Power)
- Display Leading Zeroes: check if desired.
- Energy Display:
  a. Select the Multiply by Constant value.
  b. Click the checkbox next to "Apply to the Demand Registers as well" if applicable.

A preview appears at the bottom of the screen.

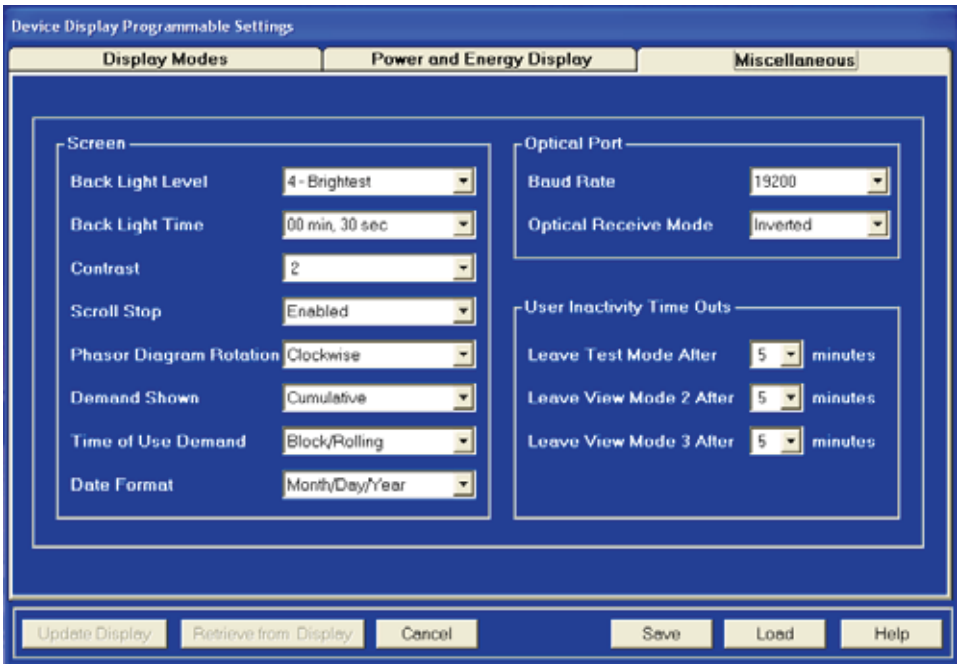
NOTES:

- Settings on this screen control the display of Energy related numbers. Be careful to match the values on the display with those in the historical logs. These settings apply to VA-hours, Watt-hours(+/-), VAR-hours (+/-) and VAR-hours (each quadrant) in the meter.

- The Number of Digits setting controls the display and storage of all digits displayed on the screen, and it sets the Register Rollover for all Energy-type registers.

Miscellaneous Tab

1. Click the Miscellaneous tab. You will see the screen shown below.



2. Enter settings in the Miscellaneous screen:

   a. Screen Settings:

   - Back Light Level: 0-Off to 4-Brightest
   - Back Light Time (Back Light shuts off): 00min, 30sec - 60min, 00sec
   - Contrast: 0 - Highest to 7 - Lowest
   - Scroll Stop: Enabled or Disabled
   - Phasor Rotation: Clockwise or Counterclockwise
   - Demand Shown: Cumulative or Continuous Cumulative
   - Time of Use Demand: Block/Rolling or Cumulative

- Date Format: Month/Day/Year or Day/Month/Year

b. Optical Port settings:

- Baud Rate: 1200, 2400, 4800, 9600, 19200, 38400 or 57600
- Optical Receive: Non-Inverted or Inverted

c. User Inactivity Time Outs (number of minutes since last user action when Mode reverts to View Mode 1) (Settings are 5 to 60 minutes with 1 minute intervals.):

- Leave Test Mode After _ Minutes
- Leave View Mode 2 After _ Minutes
- Leave View Mode 3 After _ Minutes

When you have finished programming the Device Display Programmable Settings Screen

1. Use Buttons as described below:

- **Update Display**: Click to send the new settings to the display. (After settings have been updated, View Mode 1 is displayed.)
- **Retrieve from Display**: Click to retrieve existing settings.
- **Cancel**: Click to return to the Communicator EXT Main screen without updating or saving new settings.
- **Save**: Click to save new settings to a file.

2. When you finish making any changes, click **Update Display** to send the new settings to the display. Pop-up windows tell you that the changes have been made and then you return to the Communicator EXT Main screen.

3.6: Using the Base Programmable Display

The Base Programmable Display (pre-November, 2010) has the same three configurable View modes as the Display Configurator, and the three modes are displayed in auto sequence in the same way. Using Communicator EXT, you can assign up to 16 of the pre-defined display screens to each mode: any of the available screens can be used in any mode. See Section 3.6.1 for a list of the pre-defined screens. You can also assign a three-digit label and description to the View modes, and configure the power and Energy display and screen time outs the same way as for the Display Configurator.

Programming the Base Programmable Display

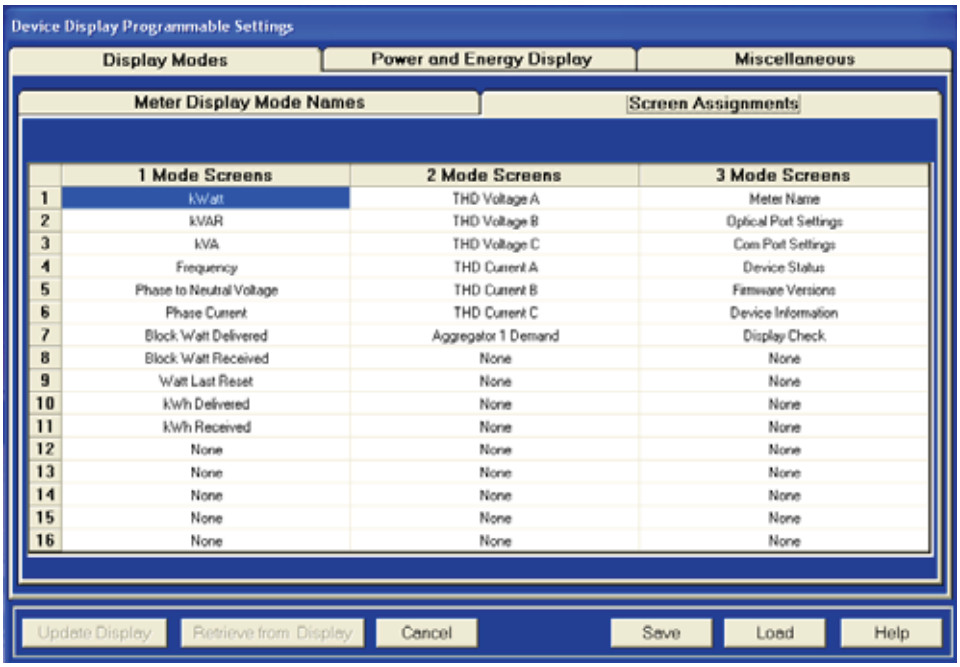
1. Connect to the meter through Communicator EXT.

2. Click the **Profile** icon to open the Device Profile screen.

3. Click the plus sign (+) next to Revenue and Energy Settings.

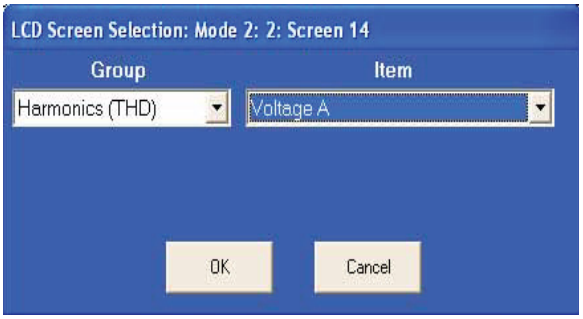
4. Double-click **Display Configuration**. You will see the Meter Display Mode Names screen. For this screen and all of the screens in the Device Display Programmable Settings **except for** the Screen Assignments screen, follow the directions given in Section 3.5. For the Screen Assignments screen, follow the directions given here.

5. Click the Screen Assignments tab. You will see the screen shown below.


Device Display Programmable Settings
Display Modes
Power and Energy Display
Miscellaneous
Meter Display Mode Names
Screen Assignments
1 Mode Screens
2 Mode Screens
3 Mode Screens
1 kWatt THD Voltage A Meter Name
2 kVAR THD Voltage B Optical Port Settings
3 kVA THD Voltage C Com Port Settings
4 Frequency THD Current A Device Status
5 Phase to Neutral Voltage THD Current B Firmware Versions
6 Phase Current THD Current C Device Information
7 Block Watt Delivered Aggregator 1 Demand Display Check
8 Block Watt Received None None
9 Watt Last Reset None None
10 kWh Delivered None None
11 kWh Received None None
12 None None None
13 None None None
14 None None None
15 None None None
16 None None None
Update Display
Retrieve from Display
Cancel
Save
Load
Help

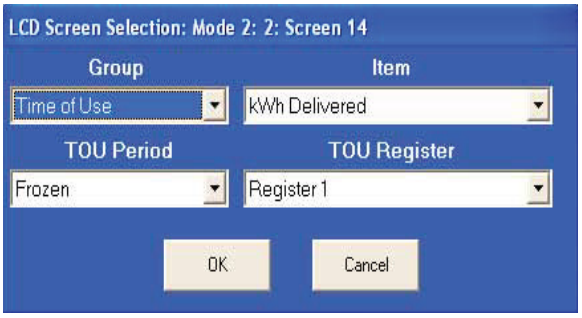
6. Your Label for each mode appears at the top of each column. Enter up to 16 screens for each View mode in the following way:

   a. Double-click on one of the 48 settings on the screen.You will see the screen shown on the right.



   b. Select Group and Item from the pull-down menus, and click **OK** to return to the Screen Assignments screen.

   NOTE: If you select Time of Use as the Group, the screen changes to allow an Item selection and additional selections for TOU Period and TOU Register. See the screen on the right.



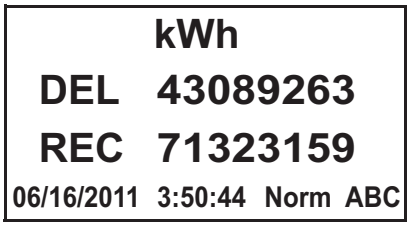
3.6.1: Pre-Defined Display Screens

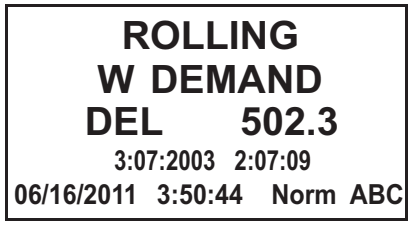
The Nexus® pre-defined display screens have features that make them very user friendly:

- Many of the screens have large digits (.56”).
- There are many screens to choose from.
- The Polling Indicator in the right corner of the Status Line provides two functions:
    1. A blinking indicator shows that the display is receiving data from the meter.
    2. Power Flow is displayed by different shaped icons.
        a. When no power is flowing, a solid block is displayed.
        b. An animated arrow pointing RIGHT indicates positive power flow.
        c. An animated arrow pointing LEFT indicates negative power flow.

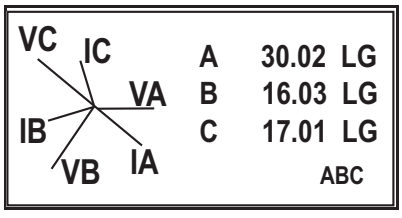
Below is a list of available screens with some example figures:

Screen Number	Screen Name
1	Wh Delivered
2	Wh Received
3	+VARh
4	-VARh
5	VAh
11	Rolling W Demand Del
12	Rolling W Demand Rec
13	Block W Demand Del
14	Block W Demand Rec
15	W Demand Last Reset
16	Phase to Neutral Voltage





17	Phase Current
18	Phasors
20	VAR, PF, Frequency
21	Va, Vab Harmonics
22	Vb, Vbc Harmonics
23	Vc/Vca Harmonics
24	Ia Harmonics
25	Ib Harmonics
26	Ic Harmonics
45	Totalizer 1
46	Totalizer 2
47	Totalizer 3
48	Totalizer 4
49	Totalizer 1 Demand
50	Totalizer 2 Demand
51	Totalizer 3 Demand
52	Totalizer 4 Demand
53	Cumulative Demand, Del & Rec
54	Phase to Phase Voltage
55	W
56	VAR
57	PF
58	VA



59	Frequency
60	Segment Check
61	Q
63	Meter Name
64	Optical Port
65	Com Port Settings
66	Nexus Status
67	Firmware Versions
68	Nexus Info
69	Average PF Received
70	Average PF Delivered
71	VARh per Quadrant
72	VAh per Quadrant
73	Wh per Quadrant
74	Qh
75	Cumulative Demand
76	Rolling Window Demand
77	Block Window Demand
78	Power Factor per Phase
79	Power Factor per Quadrant
80	TOU Wh, Rec
81	TOU VAh, Q1
82	TOU VARh, Q1

83	TOU VAh, Q4
84	TOU VARh, Q4
85	TOU Wh, Del
86	TOU VAh, Q2
87	TOU VARh, Q2
88	TOU VAh, Q3
89	TOU VARh, Q3
90	TOU W Demand, Rec
91	TOU W Demand, Del
92	TOU + VAR Demand
93	TOU-VAR Demand

This page intentionally left blank.

4: Performing Meter Testing

The information contained within this chapter is intended to be an aid to qualified metering personnel. It is not intended to replace the extensive training necessary to install or remove meters from service. Any work on or near energized meters, meter sockets or other metering equipment presents the danger of electrical shock, personal injury or death. All work on these products must be performed by qualified industrial electricians and metering specialists **ONLY**. All work must be done in accordance with local utility safety practices and/or the procedures outlined in the current edition of the Handbook for Electricity Metering. The handbook is available from the Edison Electric Institute, 701 Pennsylvania Avenue N.W., Washington D.C. 20004-2696.

4.1: Testing Tools

The Nexus® 1262 and 1272 meters are equipped with a light-emitting diode (LED) for calibration and a liquid crystal display with test screens. These two standard features provide user interface and equipment interface points for meter testing.

Figure 4.1: Meter Test Pulse and Test Button Location

4.1.1: Test Pulse LED

The Test Pulse LED is located in the upper left-hand portion of the meter face as shown in Figure 4.1. The Test Pulse LED continuously emits calibration pulses (infra-red light). This LED can be used for a variety of pulses including individual quadrants for Watt-hour, VA-hour, VAR-hour and Watt Demand pulses. Each calibration pulse is equal to the value assigned to Kt (Watt-hours per pulse) in the meter's Device Profile. The millisecond duration of each output pulse is also programmable in the meter's Device Profile.

To program the Test Pulse LED:

1. From the Device Profile menu in Communicator EXT, click **Revenue and Energy Settings>Internal KYZ** to configure the following settings:

   a. Assigned Channel - choose from settings.

   b. Watt-hour per Pulse - enter the value in the secondary.

   c. Pulse Width - set from 5ms to 635ms.

   d. Mode - select to enable or disable.

   e. Form - select between Form A and Form C.

2. Click **OK** and then click **Update Device** to send the new settings to the meter.

NOTE: The unit for the calibration pulses is Watt-hours. The initial value of each pulse (Kt) is 1.800 secondary Watt-hours per pulse.

4.1.2: LCD Display

In Test Mode, the LCD display provides user access to accumulated real, reactive and apparent energy as well as Block Demand for real power. There are eight screens in Test Mode: Wh - Del, Wh - Rec, VARh - Q1 & Q2, VARh - Q3 & Q4, VAh - Q1 & Q4, VAh - Q2 & Q3, Watt Demand Test Rolling and Watt Demand Test Block. See Section 4.2.2 for more detail.

The LCD display also includes three phase Voltage indicators. These indicators are labeled A, B and C to represent the presence of Voltage on the labeled phase.

If Voltage is not present on one phase, its indicator is not displayed. These indicators also show whether current is flowing on the phase. If no current is flowing on a phase, the indicator blinks; when current is flowing, the indicator shows a continuously illuminated digit. The indicator also shows phase sequence.

4.2: Test Mode

Test Mode allows the meter to be tested without disturbing billing data or setting a new maximum Demand. Test Mode performs the same function as setting the pointers back on an electromechanical meter after testing.

While operating in Test Mode, the meter uses the same measurement and calculation processes that are used in Normal Mode. The only difference is that the billing numbers stored in the meter are not updated with the real-time reading. This preserves the billing numbers while testing is performed.

4.2.1: Entering Test Mode

To enter Test Mode, you must bypass the meter's security system. In most instances, this requires you to remove power from the meter, break the meter seal and remove the Lexan cover, and then repower the meter.

4.2.2: Using Test Mode

The same selected measurement profile quantities (data accumulations) that are calculated during normal operation are calculated in Test Mode. Display quantities (Watt-hour, VAR-hour, Volt-Ampere-hour and Block Demand quantities) are displayed in units rather than kilo-units; i.e. the data is displayed as Wh, VARh, VAh and Watts rather than kWh, kVARh, kVAh and kW. The same Demand values calculated during normal operation are also calculated in Test Mode. The display formats in Test Mode are changed to provide greater resolution during test operations.

The display does not scroll while in Test Mode. Each item remains displayed until the Test Button is pressed, which causes the next Test Mode screen to display.

The following table shows the display screens available in Test Mode, the data displayed on each screen and the pulse source for each screen.

Test Mode Displayed Data and Pulse Source		
Test Mode	**Displayed Data**	**Pulse Source**
Wh - Del	Delivered Wh Energy	kWh, Del
Wh - Rec	Received Wh Energy	kWh, Rec
VARh - Q1 and Q2	VARh in Quadrant1 VARh in Quadrant 2	kVARhr, Del
VARh - Q 3 and Q4	VARh in Quadrant 3 VARh in Quadrant 4	kVARhr, Rec
VAh - Q1 and Q4	VAh in Quadrant 1 VAh in Quadrant 4	kVAhr, Q1
VAh - Q2 and Q3	VAh in Quadrant 2 VAh in Quadrant 3	kVAhr, Q3
Watt Demand Rolling	Watt Rolling Demand Delivered	kWH, Del
Watt Demand	Watt Block Demand Delivered	kWh, Del

Test Mode Details

The Reset Button (R) is next to the Test Button (T). Initiate a Test Mode Reset by pressing and releasing the Reset Button while in Test Mode. A Test Mode Reset causes all test quantities to be reset to zero and a new block interval to be started. The item displayed when the reset occurred remains in the display but the value is initialized.

While in Test Mode, the Test Pulse LED pulses at the rate programmed for the meter. The value of the pulse is set in the meter's Device Profile (see Section 4.1.1). The meter quantity assigned to the Test Pulse LED changes as the user moves from one test screen to another. The assigned values are defined in the Pulse Source column of the table above.

Individual quadrant tests for VAR-hours can be completed by proper test design. To test strictly VAR-hours, limit the test parameters to one quadrant during testing.

In the event of a power outage, data for Test Mode Energy, Demand and Power Factor is not saved. Upon power up, the meter returns to Normal Mode. The test data is lost and all registers are restored to their pretest values.

While in Test Mode, the IR Port and Communications Port 1 are available for communication with the meter.

In Test Mode, you can preset the values of the energy readings that will be restored to the meter when Test Mode is exited, using Communicator EXT (see following section 4.2.3).

4.2.3: Test Mode Preset Accumulators

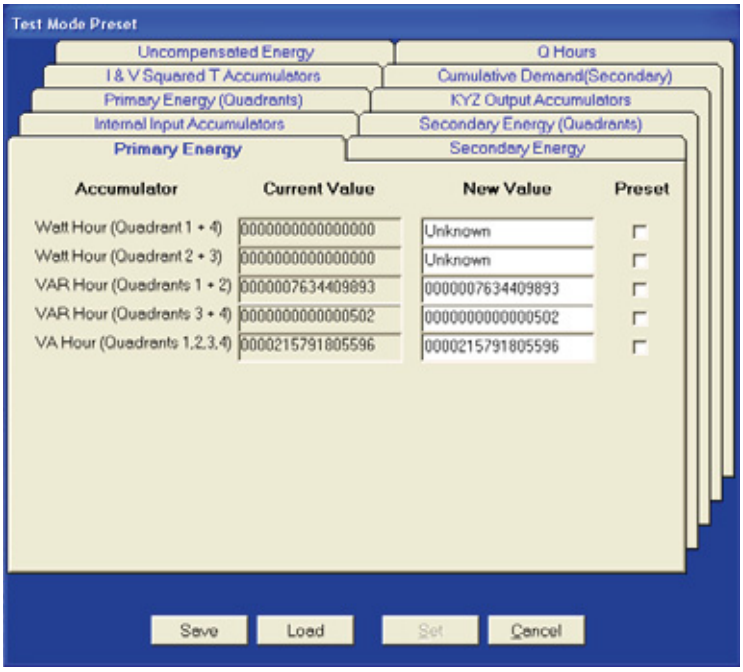
There are two reasons to use the Preset Accumulators screens:

1. A monitor in Test Mode is out of service and is therefore not monitoring accumulations. The New Value field can be used to adjust for the values not monitored while in Test Mode.

2. When replacing an old meter that has accumulations with a new meter that has no accumulations, the New Value field can be set to the value of the existing accumulations.

Setting Test Mode Preset Accumulators

1. From Communicator EXT's Main screen, select **Tools>Test Mode>Preset Accumulators**. You will see the screen shown below.



2. Click Tabs at the top of the screens to access the individual screens.

   - Each screen has a Current Value, New Value and Preset Box for each accumulator.
   - A new meter has zeros for Current Values.

3. Settings can be preset for the following sets of values:

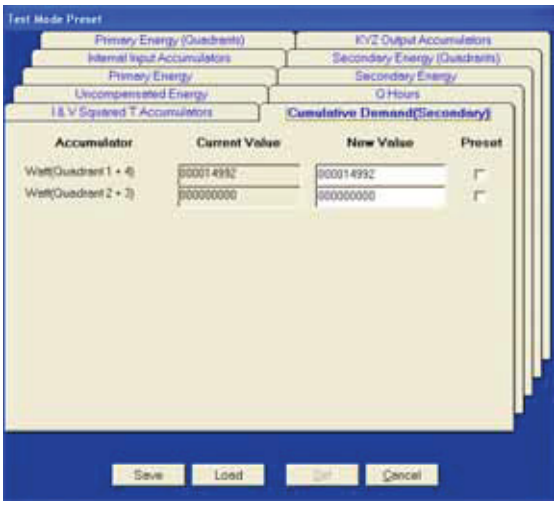
   - Primary Energy
   - Secondary Energy
   - Primary Energy (Quadrants)
   - Secondary Energy (Quadrants)
   - Internal Input Accumulators
   - KYZ Output Accumulators

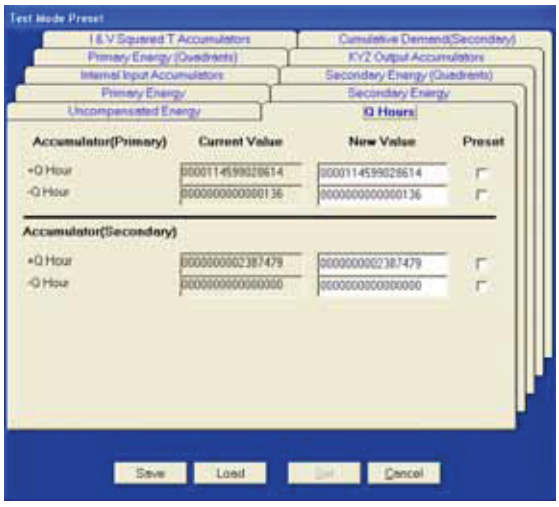
- Q Hours
- I & V Squared T Accumulators
- Cumulative Demand (Secondary)
- Uncompensated Energy

Examples of some of the screens are shown below.

4. Click the Preset Boxes for the values you want to set.

5. Click **Set** to save your entries or **Cancel** to exit the screen without saving any changes.





4.2.4: Exiting Test Mode

Exit Test Mode in one of the following three ways:

- Press and hold the Test Button for more than 3 seconds.
- Use the Test Mode Time-out Timer, if no load is present.
- Use the Extended Test Mode Time-out Timer, if load is present.

These options are explained further in the following sections.

Exiting Test Mode Details:

Test Mode Button

Pressing the Test Mode Button for more than three seconds ends Test Mode and returns the meter to Normal Mode.

Test Mode Time-out Timer

The Test Mode Time-out Timer has two modes of operation, depending on whether the meter sees measurable load.

If the meter does not recognize measurable load:

The meter watches for user interaction by monitoring activity on the Test Button and the Reset Button. If neither button is pushed within the programmed Exit Delay time, the meter exits Test Mode and returns to Normal Mode. Each time the Test or Reset Button is pressed, the meter starts the Exit Delay Timer again. The Exit Delay time is programmed in the meter's Device Profile in the Device Display Programmable Settings screen, Miscellaneous tab (see Section 3.6).

If the Meter recognizes measurable load:

The meter watches the Test and Reset Buttons for activity, using an extended time limit consisting of the Exit Delay time plus the programmed Block Interval Time. This insures that the meter completes a full block Demand test without interruption.

After exiting Test Mode:

All Test Mode data is lost when you exit Test Mode. Upon exiting Test Mode, a new (possibly partial) Demand interval and subinterval begin. The past subinterval as well

as the current subinterval are zeroed. Upon returning to Normal operating mode, a TOU meter or Demand meter with load profiling completes the time remaining in the current partial subinterval so that subsequent subintervals are synchronized with the hourly boundary.

Maximum Demand values for each Demand integration type are not modified while in Test Mode. The previously recorded maximums are restored when you exit Test Mode. If you choose to reset Demand data during testing operations, you can complete this action when you exit Test Mode by pressing the Reset Button after the meter returns to Normal Mode.

NOTE: Normal billing and historical log data accumulation is suspended during Test Mode operation. Upon exiting Test Mode, accumulation of billing and historical log quantities does either of the following:

- Resumes from the values in place when Test Mode was entered
- Continues from the Test Mode Preset values (see Section 4.2.4)

This page intentionally left blank.

5: Serial Communication Wiring

5.1: Communication Overview

The figure below shows serial communication options.

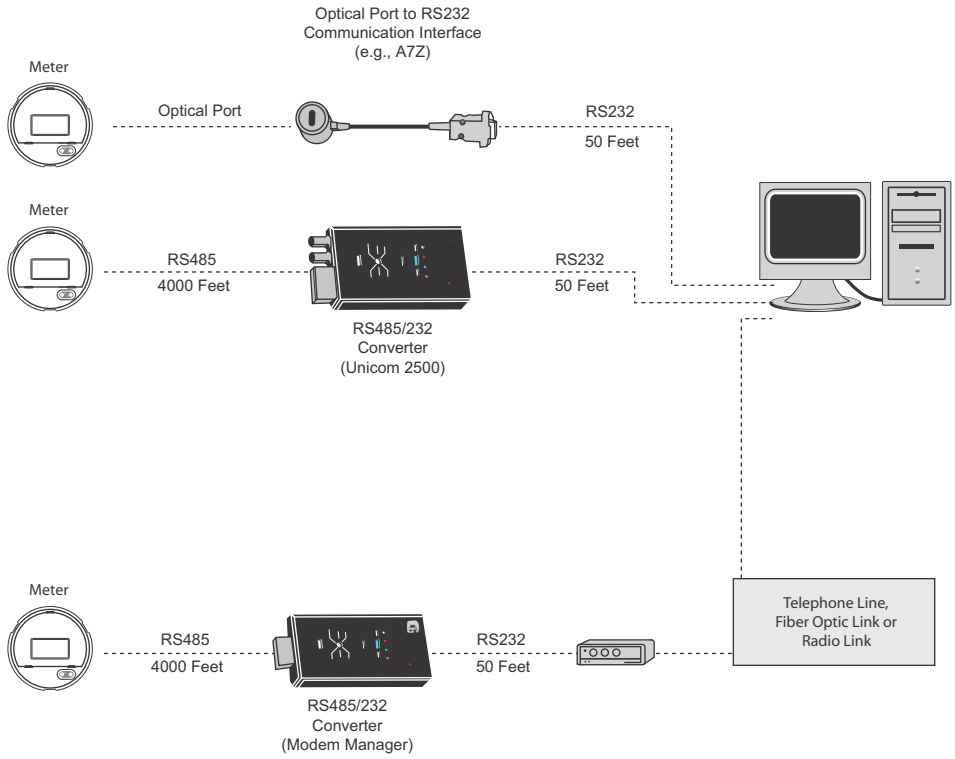


Figure 5.1: Serial Communication

RS232 communication is used to connect a single Nexus® 1262/1272 meter with another device, such as a computer, RTU or PLC. The link is viable for up to 50 feet (15.2 m) and is available only through the meter's Optical port with a communication interface (Optical port to RS232 converter); see figures 5.2 and 5.3.

RS485 communication allows multiple meters to communicate with another device at a local or remote site. The I/O modules and external displays use RS485 to communicate with the meter. All RS485 links are viable for up to 4000 feet (1220 m). The Nexus® Socket meter's Ports 1 and 4 are two-wire, RS485 connections (up to 115200 baud). Optional Communication Connections for INP2 (Internal Modem with Dial In/Dial Out), INP200 (10/100BaseT connection) or INP202 (Combination Modem and Ethernet) are cables with appropriate connectors (see Chapter 6 and Figure 6.2).

Figure 5.2: Optical Port Location

5.2: Communicating to the Meter through the ANSI Type II Optical Port

The Optical port allows the Nexus® 1262/1272 meter to communicate with one other device, e.g., a PC. Located on the left side of the meter's face, it provides communication with the meter through an ANSI C12.13 Type II Magnetic Optical Communications Coupler, such as either:

- An A7Z Communication Interface connected to the RS232 port of the PC
- An A9U Communication Interface connected to the USB port of the PC.

You can order the A7Z or A9U from EIG's webstore: www.electroind.com/store. Select the Communications Products category from the left side of the webpage.

See Figure 5.3.

Figure 5.3: A7Z (Top) and A9U (Bottom) Communication Interfaces

A7Z Instructions:

One end of the magnetic interface simply snaps onto the optical port; the magnet keeps it in place. The other end is an RS232 connection. Insert that end into a 9-pin serial port on a computer or other device. The A7Z requires no power supply. All power is received from the host computer serial port using transmitter and receiver

circuits within the probe. The RS232 standard limits the cable length to 50 feet (15.2m).

A9U Instructions:

You need to download and install the driver for the A9U from EIG's website: www.electroind.com/A7Z_A9U.html. Once the driver is installed, attach the A9U's magnetic interface onto the meter's Optical port and attach the A9U's USB connection into your PC.

5.3: RS485 Serial Communication

RS485 communication allows multiple devices to communicate on a bus. The meter's Port 1 and Port 4 are RS485 terminals, viable for a distance of up to 4000 feet (1219 meters).

5.3.1: RS485 Wiring Fundamentals - (Port 1 and Port 4)

Below is a detailed view of a 2-wire RS485 connection.

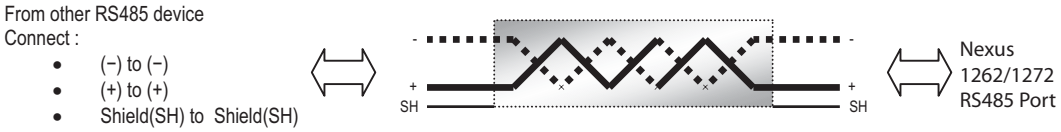


Figure 5.4: RS485 Connection Detail

- **S** (Shield): This is not an earth-ground connection. You must also connect the shield to earth-ground at one point. Do not connect the shield to ground at multiple points; it will interfere with communication.

- **+/-** (Two-wire, RS485 communication terminals): Connect the + terminal of the meter port to the + terminal of the device. Connect the - terminal of the meter port to the - terminal of the device.

NOTES on RS485 Connections:

- Use a shielded twisted pair cable 22 AWG (0.33 mm^2) or larger, grounding the shield at one end only.

- Establish point-to-point configurations for each device on a RS485 bus: Connect (+) terminals to (+) terminals; connect (-) terminals to (-) terminals.

- Protect cables from sources of electrical noise.

- Avoid both "star" and "tee" connections (see Figure 5.6).

- No more than two cables should be connected at any one point on an RS485 network, whether the connections are for devices, converters or terminal strips.

- Include all segments when calculating the total cable length of a network. If you are not using an RS485 repeater, the maximum length for cable connecting all devices is 4000 feet (1219 meters).

- For an RS485 Daisy Chain connection, in which you link multiple devices in a series, connect shield to RS485 Master and individual devices as shown in Figure 5.5. You may also connect the shield to earth-ground at one point.

- The Nexus® 1262/1272 meter may be shipped with connectors on the ends of cables or they may be shipped as pigtails (no connectors). In this case, a generic terminal block is shipped with the meter. The terminal block has up to 12 connectors and can be cut into smaller sections with a utility knife. Please refer to the Cable Color Key on pages 6-5 to 6-7, if you are using pigtails or if you have any question about which connector is which.

- Termination Resistors (RT) are generally used on both ends of longer length transmission lines. The value of the Termination Resistors is determined by the electrical parameters of the cable. Termination Resistors are only needed with runs typically more than 500 feet, as the meter has some level of termination internally and usually resistors are not needed.

- For information on connecting the meter to a modem, see Section 5.3.11.

Figure 5.5 shows a representation of an RS485 Daisy Chain connection. You can connect up to 31 slaves in a Daisy Chain.

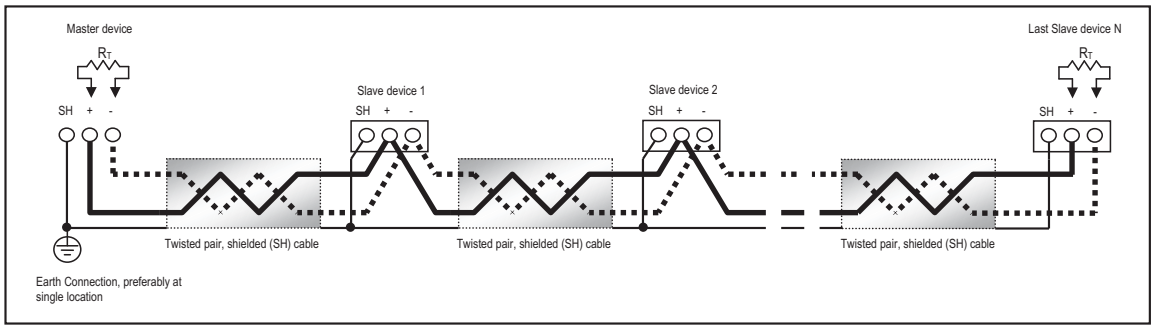


Figure 5.5: RS485 Daisy Chain Connection

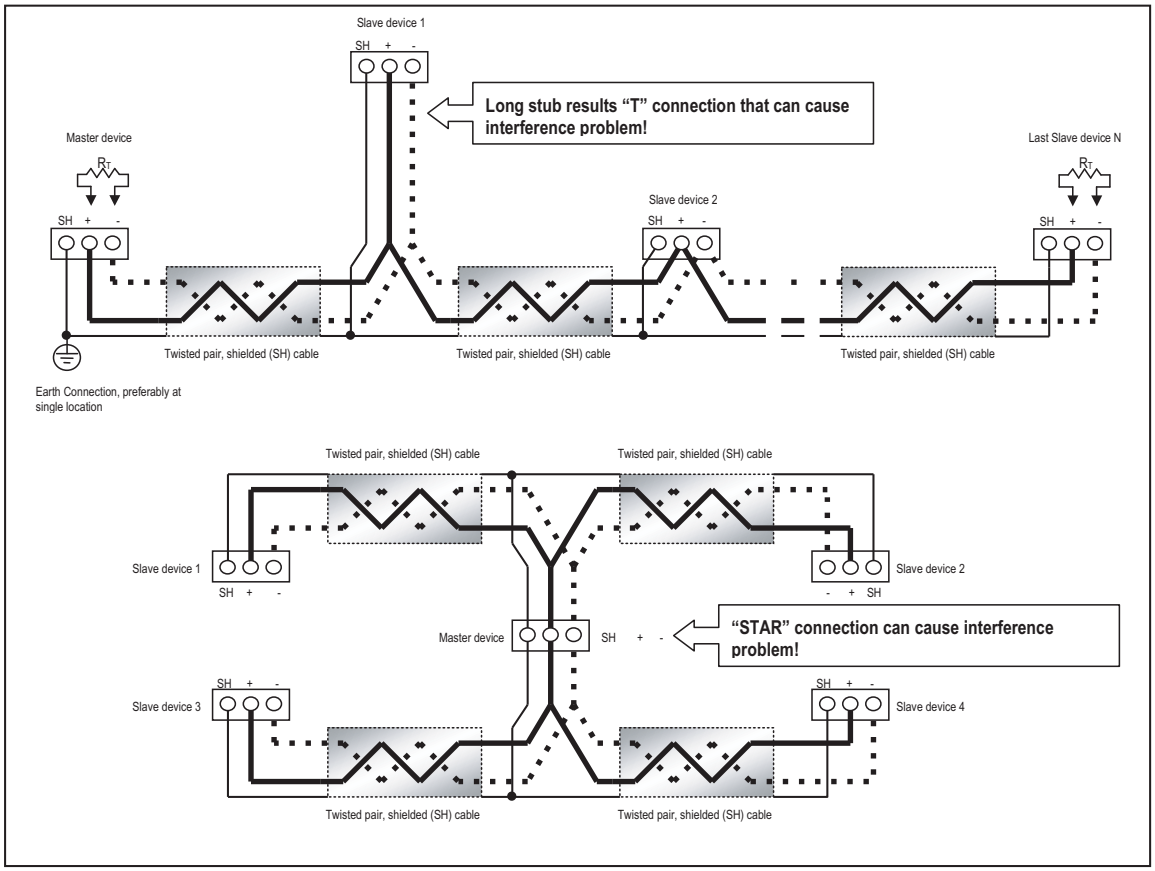


Figure 5.6: Incorrect "T' and "Star" Topologies

5.3.2: Using the Unicom 2500

The Unicom 2500 provides RS485/RS232 conversion. In doing so it allows the Nexus® meter to communicate with a PC or other device. See the *Unicom 2500 Installation and Operation Manual* for additional information. You can order the Unicom 2500 from EIG's webstore: www.electroind.com/store. Select the Communications Products category from the left side of the webpage.

Figure 5.7 illustrates the Unicom 2500 connections for RS485.

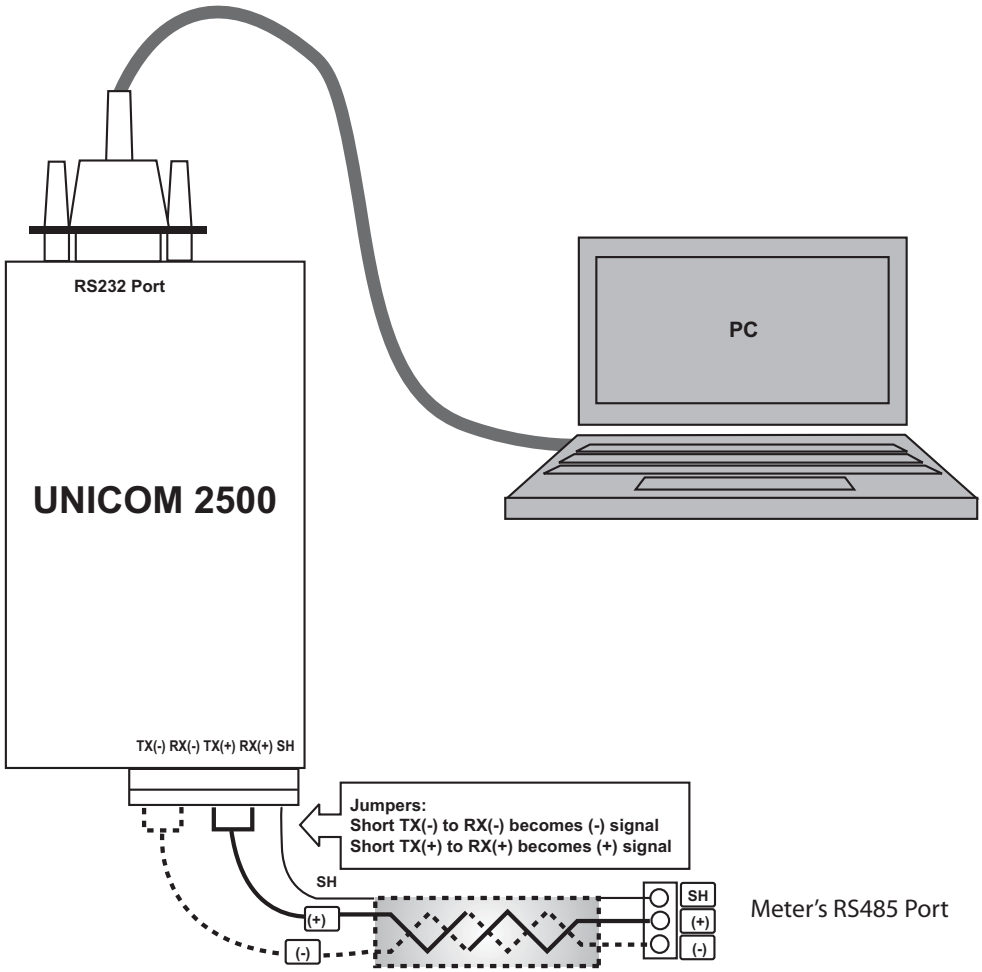
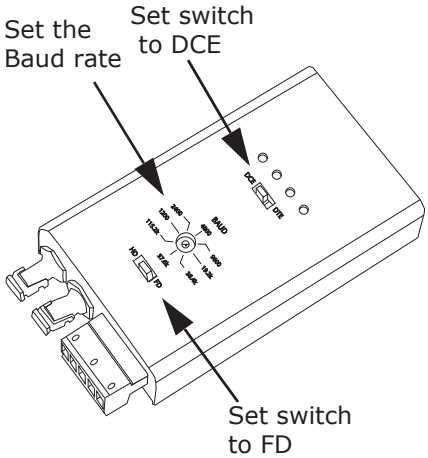


Figure 5.7: Meter Connected to a PC Using Unicom 2500

The Unicom 2500 can be configured for either 4-wire or 2-wire RS485 connections. Since the Nexus® meter uses a 2-wire connection, you need to add jumper wires to convert the Unicom 2500 to the 2-wire configuration.

As shown in Figure 5.7, you connect the "RX-" and "TX-" terminals with a jumper wire to make the "-" terminal, and connect the "RX+" and "TX+" terminals with a jumper wire to make the "+" terminal. See the figure on the right for the Unicom 2500's settings. The Unicom's Baud rate must match the Baud rate of the meter's RS485 port: you set the Baud rate by turning the screw to point at the rate you want.



5.3.3: RJ11 (Telephone Line) Connection—Meter with INP2 (Internal Modem with Dial In/Dial Out) Option

Use RJ11 Standard Telephone Line to connect with the meter. The RJ11 line is connected to Cable 5 from the back of a meter with the Internal Modem Option. The RJ11 connector is supplied with the meter.

The length of the connection using RJ11 into the meter is virtually unlimited. To connect with other meters in either local or remote locations, you MUST use Cable 5.

For more information on the meter with the INP2 Option, see Section 5.4.

5.3.4: RJ45 Connection—Meter with INP200 (10/100BaseT) Option

The INP200 Option conforms to the IEEE 802.3, 10/100BaseT specification using unshielded twisted pair (UTP) wiring. This allows you to use inexpensive RJ45 connectors and CAT 3 or better cabling. The RJ45 connector is supplied with the meter (Cable 6).

Using this LAN connection allows multiple PC's to access the meter concurrently. The RJ45 line is inserted into the RJ45 connector on Cable 6 coming from the bottom of a meter with the Ethernet Option. The connection using RJ45 into the meter connects the meter to a network using Modbus/TCP protocol over Ethernet.

For more information on a meter with the INP200 Onboard Ethernet (10/100BaseT), see Section 5.5.

5.3.5: Modem/Ethernet Connection—Meter with INP202 (Combo Card) Option

The INP202 is an extension of INP200. It has all the features of INP200 plus a built-in Modem. Modem and Ethernet capabilities can be used simultaneously.

The communication protocol supported by the modem is Modbus ASCII. The Communication protocol supported by the RS485 Ethernet Modem Gateway is Modbus RTU. INP202 converts all incoming modem Modbus ASCII requests to Modbus RTU for internal and gateway communication. It then converts all response Modbus RTU messages into Modbus ASCII protocol before it sends the responses to the modem.

Some of the fixed parameters for the Ethernet Modem Gateway are: 8 Data Bits, Even Parity, 1 Stop Bit. The Ethernet/Modem's Gateway's Baud Rate and Delay Time are configurable.

For more information on a meter with the INP202 Modem/Ethernet Combo Card, see Section 5.6.

5.3.6: RS485 Connection - Meter to the P40N/P40N+/P41N+/P43N+ LED Display

Connect the communication wires of the supplied RS485 cable to the meter's Port 1 or Port 4. Set the port's Baud Rate to 9600, Address to 1, Protocol to Modbus RTU and Mode to Slave using the communication software. Insert the other end of the communication wires into the back of the first LED Display.

The Nexus® 1262/1272 meter's power supply does not supply power to external displays. You must use a power source, such as the EIG PB1 (12V). (See Section 10.2.1 for PSIO details.)

RS485 communication is viable for up to 4000 feet (1219 meters). Be sure to do the following:

1. Connect the shield to the shield (S) terminal on the Display port. The (S) terminal on the meter is used to reference the meter's port to the same potential as the source. It is not an earth-ground connection. You may also connect the shield to earth-ground at one point.

2. Provide termination resistors at each end for longer runs (typically 500' or more), connected to the + and - lines. RT is approximately 120 Ohms.

NOTE: The P40N+ and legacy P40N connect the same way, through the port on the back of the display. The only difference is in the port labeling.

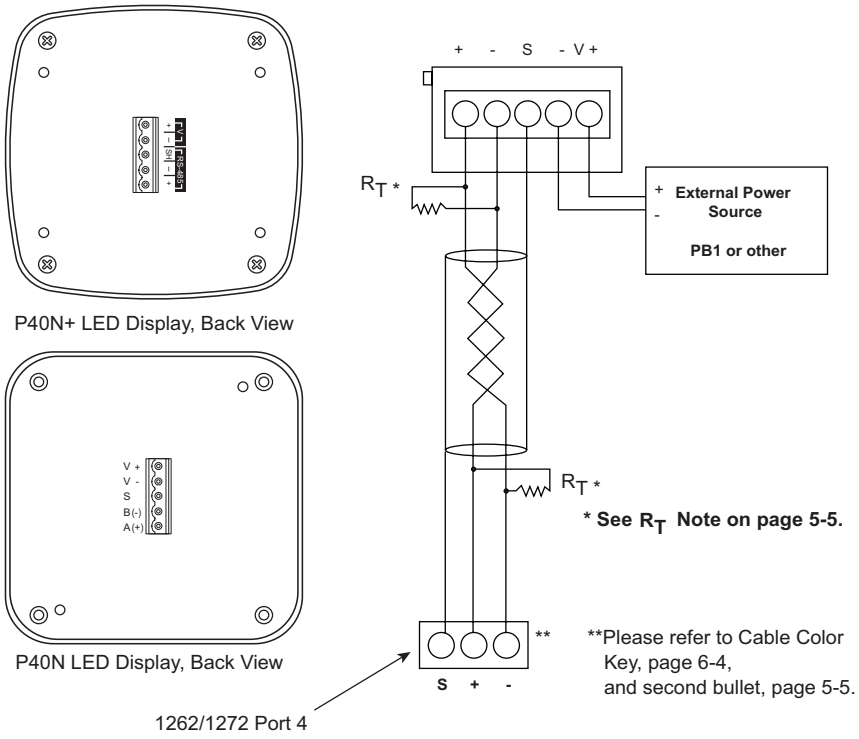


Figure 5.8: P41N+ and Legacy P40N External Display RS485 Connection

5.3.7: Communication Ports on the I/O Modules

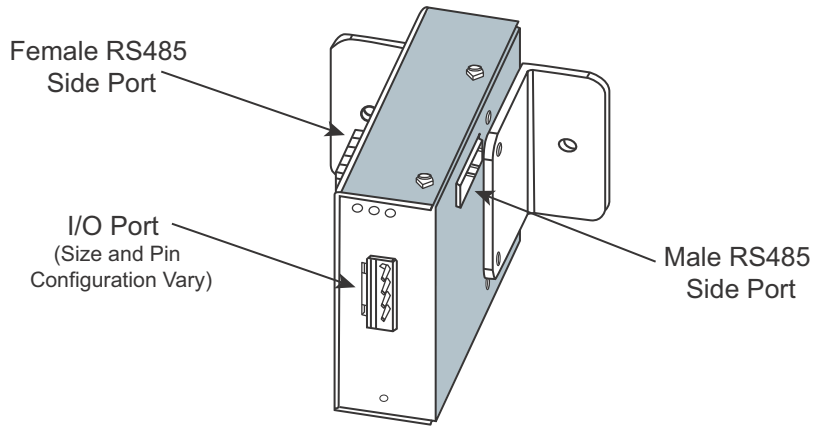


Figure 5.9: I/O Module Communication Ports

Female RS485 Side Port: use to connect to another module's male RS485 side port.

Male RS485 Side Port: use to connect to the meter's Port 4 (see following section) or to connect to another module's female RS485 side port (see Section 10.3.1).

I/O Port: use for functions specific to the type of module; size and pin configuration varies depending on type of module. For more detail, refer to Chapter 10.

5.3.8: RS485 Connection—Meter to I/O Modules

An RS485 cable harness is supplied with the purchase of MBIO (mounting brackets). Wire one end of the cable to the meter's Port 4.

Insert the other end of the cable into the communication pins of the I/O module's male RS485 side port (see Figure 5.9). See Section 10.3.1 for details on using multiple I/O modules.

The Nexus® 1262/1272 meter's power supply does not supply power to the I/O modules. You must use a power source, such as the EIG PSIO or PB1 (12V). See Section 10.2.1 for PSIO details.

RS485 communication is viable for up to 4000 feet (1219 meters). Follow the wiring shown in Figure 5.10 and be sure to:

1. Connect the + and - terminals on the meter to the + and - terminals of the female RS485 port. Connect the shield to the shield (S) terminal. The (S) terminal on the meter is used to reference the meter's port to the same potential as the source. It is not an earth-ground connection. You may also connect the shield to earth-ground at one point.

2. Provide termination resistors at each end for longer runs (typically more than 500'), connected to the + and - lines. RT is approximately 120 Ohms.

NOTES:

- The meter has some level of termination internally and usually resistors are not needed.

- Refer to the Cable Color Key on pages 6-5 to 6-7.

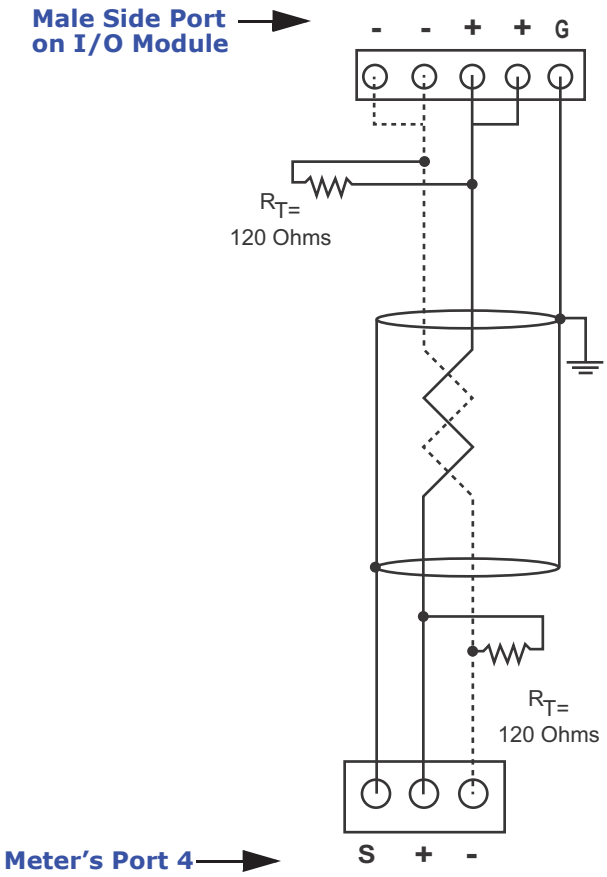


Figure 5.10: Meter and I/O Module Connections

5.3.9: Steps to Determine Power Needed

Since the Nexus® 1262/1272 meter's power supply does not supply power to the I/O modules, you need to use a power source, such as EIG's PSIO, which is designed for use with the I/O modules. Follow these steps to determine how many PSIO units you need.

1. All I/O modules are shipped pre-programmed with a baud rate of 57600 and individual addresses. Refer to the following table to determine the VA Ratings for the I/O modules.

I/O Module Factory Settings and VA Ratings

Model#	Module	Address	VA Rating
1mAON4	0-1mA, 4 Analog Outputs	128	2.7VA
1mAON8	0-1mA, 8 Analog Outputs	128	3.2VA
20mAON4	4-20mA, 4 Analog Outputs	132	5.0VA
20mAON8	4-20mA, 8 Analog Outputs	132	8.5VA
8AI1	0-1mA, 8 Analog Inputs	136	2.3VA
8AI2	0-20mA, 8 Analog Inputs	140	2.3VA
8AI3	0-5VDC, 8 Analog Inputs	144	2.3VA
8AI4	0-10VDC, 8 Analog Inputs	148	2.3VA
4RO1	4 Latching Relay Outputs	156	2.7VA
4PO1	4 KYZ Pulse Outputs	160	2.7VA
8DI1	8 Status Inputs (Wet/Dry)	164	1.0VA

2. Add together the VA Ratings for the I/O modules in use to determine total power needed.

3. Each PSIO supplies 12 VA @ 12VDC. For details on the PSIO, see sections 10.2.1 and 10.3.

NOTE: For 24 or 48 VDC applications, EIG recommends the PB1 power supply.
Example order number: PB1-D-12VO (PB1)

If you are using a PSIO (for 125V AC/DC input) or PB1 your maximum VA is 12.

5.3.10: Remote Communication Over Telephone Lines Using the RS485 Port

Use modems (dedicated or dial-up) when devices are at great distances. EIG recommends using RS485 wiring with a Modem Manager.

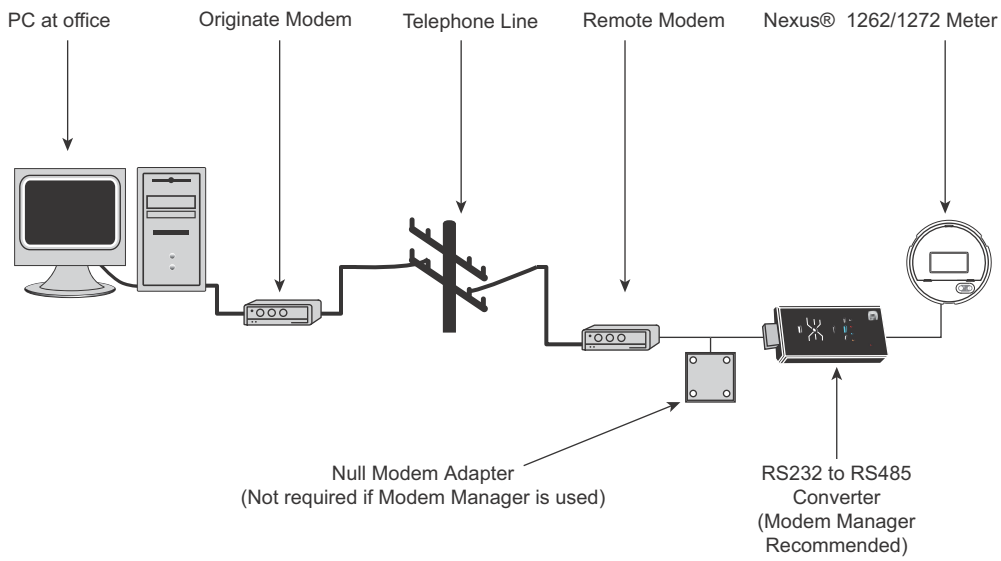


Figure 5.11: Remote RS485 Connections

Use Port 1 or Port 4 for RS485 communication. The link using RS485 is viable for up to 4000 feet (1219 meters).
Use Communicator EXT software to set the port's baud rate to the appropriate speed for your hardware and/or network and enable Modbus ASCII protocol. See the *Communicator EXT User Manual* for instructions. Remember, Modbus RTU will not function properly with modem communication.You **must** change the protocol to Modbus ASCII.
You must use an RS485 to RS232 converter and a Null Modem. EIG recommends using its Modem Manager. This converter has a built-in null modem and also provides line data buffering, making the telephone line communication reliable; most commer-

cial modems do not. For this reason, EIG recommends the Modem Manager to alleviate any communication line errors that might occur. Using the Modem Manager also eliminates the need to program default settings into the modem, which makes installation simpler.

5.3.11: Programming Modems for Remote Communication

You must program a modem before it can communicate properly with most RS485 or RS232-based devices. This task is often quite complicated because modems can be unpredictable when communicating with remote devices.

If you are not using EIG's Modem Manager, you must set the following strings to communicate with the remote Nexus® meter(s). Consult your modem's manual for the proper string settings or see Section 5.3.12 for a list of selected modem strings. **NOTE:** Use a Modem Manager! The product was designed to make this task "plug and play." We highly recommend it for all serial modem solutions.

Modem Connected to a Computer (the Originate Modem)

- Restore modem to factory settings. This erases all previously programmed settings.
- Set modem to display Result Codes. The computer will use the result codes.
- Set modem to Verbal Result Codes. The computer will use the verbal result codes.
- Set modem to use DTR Signal. This is necessary for the computer to ensure connection with the originate modem.
- Set modem to enable Flow Control. This is necessary to communicate with the remote modem connected to the Nexus® meter.
- Instruct modem to write the new settings to activate profile. This places these settings into nonvolatile memory; the settings will take effect after the modem powers up.

Modem Connected to the Nexus® Meter (the Remote Modem)

- Restore modem to factory settings. This erases all previously programmed settings.
- Set modem to auto answer on *n* rings. This sets the remote modem to answer the call after *n* rings.

- Set modem to ignore DTR Signal. This is necessary for the Nexus® meter, to insure connection with the originate modem.
- Set modem to disable Flow Control. The Nexus® meter's RS232 communication does not support this feature.
- Instruct modem to write the new settings to activate profile. This places these settings into nonvolatile memory; the setting will take effect after the modem powers up.
- When programming the remote modem with a terminal program, make sure the baud rate of the terminal program matches the Nexus® meter's baud rate.

5.3.12: Selected Modem Strings

Modem	String/Setting
Cardinal modem	AT&FE0F8&K0N0S37=9
Zoom/Faxmodem VFX V.32BIS(14.4K)	AT&F0&K0S0=1&W0&Y0
Zoom/Faxmodem 56Kx Dual Mode:	AT&F0&K0&C0S0=1&W0&Y0
USRobotics Sportster 33.6 Faxmodem: DIP switch setting	AT&F0&N6&W0Y0 (for 9600 baud) Up Up Down Down Up Up Up Down
USRobotics Sportster 56K Faxmodem: DIP switch setting	AT&F0&W0Y0 Up Up Down Down Up Up Up Down

5.3.13: High Speed Inputs Connection

The Nexus® 1262/1272 meter's built-in High Speed Inputs can be used in two ways:

- Attaching status contacts from relays, breakers or other devices for status or waveform initiation
- Attaching the KYZ pulse outputs from other meters for pulse counting and totalizing

Even though these inputs are capable of being used as high speed digital fault recording inputs, they serve a dual purpose as KYZ counters and totalizers. The function in

use is programmable in the meter and is configured via Communicator EXT. Refer to the *Communicator EXT User Manual* for instructions on programming these features.

The High Speed Inputs can be used to sense dry contact closures only. The meter internally generates the wetting Voltage for the contacts. The wetting Voltage is 12V DC, +/-20%.

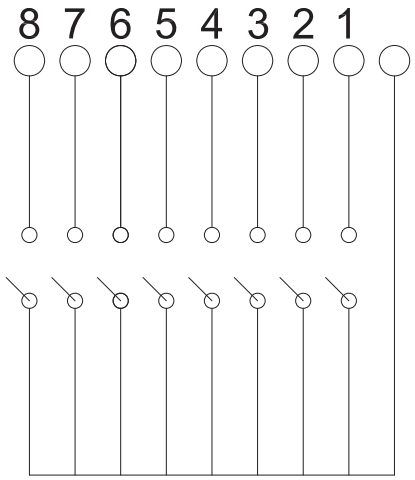


Figure 5.12: High Speed Inputs Connection

5.3.14: IRIG-B Connections

IRIG-B is a standard time code format that synchronizes event time-stamping to within 1 millisecond. An IRIG-B signal-generating device connected to the GPS satellite system synchronizes Nexus® 1262/1272 meters located at different geographic locations. Nexus® meters use an un-modulated signal from a satellite-controlled clock (such as Arbiter 1093B). For details on installation, refer to the User's Manual for the satellite-controlled clock in use. Below are installation steps and tips that will help you.

Connection:

Connect the (+) terminal of the Nexus® meter to the (+) terminal of the signal generating device; connect the (-) terminal of the Nexus® meter to the (-) terminal of the signal generating device.

Installation:

Set Time Settings for the meter being installed.

1. From the Communicator EXT Device Profile menu:
   a. Click **General Settings>Time Settings>one of the Time Settings lines**, to open the Time Settings screen.
   b. Set the Time Zone and Daylight Savings (Select **AutoDST** or **Enable** and set dates).
   c. Click **Update Device Profile** to save the new settings. (See Chapter 4 of the *Communicator EXT User's Manual* for details.)
2. Before connection, check that the date on the meter clock is correct (or, within 2 Months of the actual date). This provides the right year for the clock (GPS does not supply the year).
3. Connect the (+) terminal of the Nexus® meter to the (+) terminal of the signal generating device; connect the (-) terminal of the Nexus® meter to the (-) terminal of the signal generating device.

Troubleshooting Tip:

The most common source of problems is a reversal of the two wires. If you have a problem, try reversing the wires.

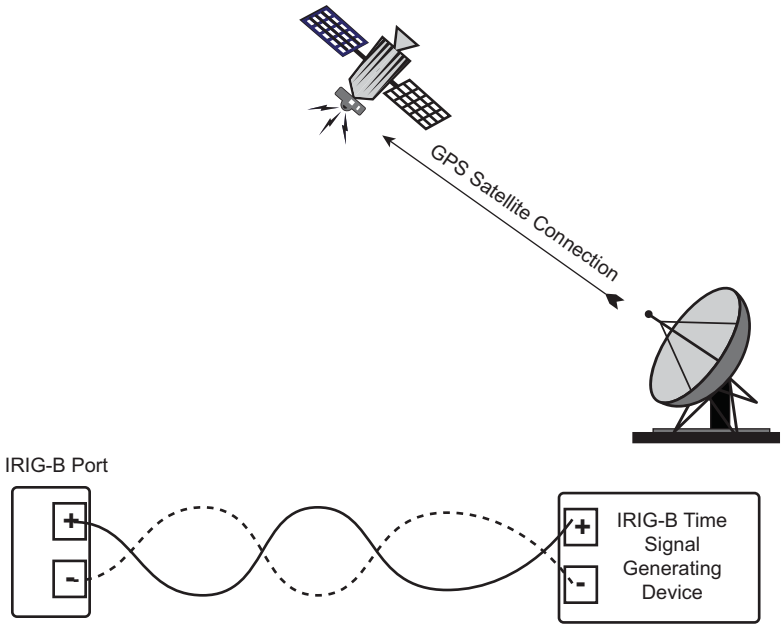


Figure 5.13: IRIG-B Communication

NOTE: Please make sure that the selected clock can drive the amount of wired loads.

5.3.15: Time Synchronization Alternatives

(See the *Communicator EXT User Manual* for details.)

IRIG-B

- All Nexus® 1262/1272 meters are equipped to use IRIG-B for time synchronization.
- If IRIG-B is connected, this form of time synchronization takes precedence over the internal clock. If the GPS Signal is lost, the internal clock takes over time keeping at the precise moment the signal is lost.

Line Frequency Clock Synchronization

- All Nexus® meters are equipped with Line Frequency Clock Synchronization, which may be enabled or disabled for use instead of IRIG-B. If Line Frequency Clock Synchronization is enabled and power is lost, the internal clock takes over at the precise moment power is lost.

Internal Clock Crystal

- All Nexus® meters are equipped with internal clocks crystals which are accurate to 20ppm, and which can be used if IRIG-B is not connected and/or Line Frequency Clock Synchronization is not enabled.

DNP Time Synchronization

- Using Communicator EXT, you can set the meter to request time synchronization from the DNP Master. Requests can be made from once per minute to once per day. See the *Nexus® 1252/1262/1272/1500 DNP User Manual* for instructions. You can download the manual from EIG's website: www.electroind.com/pdf/DNPv3.0_Level2.pdf.

Other Time Setting Tools

- **Tools>Set Device Time**: For manual or PC time setting
- **Script & Scheduler**: Time stamps retrieved logs and data

- **MV90**: Can synchronize time on retrievals in the form of a time stamp. Refer to the *Communicator EXT User Manual* (HHF Converter instructions) for more MV-90 details.

5.4: INP2 Internal Modem with Dial-In/Dial-Out Option

The INP2 Internal Modem option gives the Nexus® 1262/1272 meter RJ11 connection as well as Dial-In/Dial-Out remote communication.

5.4.1: Hardware Overview

The INP2 Option for the Nexus® 1262/1272 meter provides a direct connection to a standard telephone line. No additional hardware is required to establish a communication connection between the meter and a remote computer.

The modem operates at up to 56k baud. The internal connection between the modem and the meter includes a memory buffer. This enables the modem to connect to the phone line at any speed and to change speed during the communication connection to the remote PC. The buffer between the meter and the modem allows the meter to communicate into the modem at a constant speed while the modem telephone line speed can vary. This eliminates the synchronizing problems that are common with other devices. It also increases the effective throughput of the communication channel. This, in turn, decreases connection time and connection costs.

The modem supports both incoming calls (from a remote computer) and automatic dial-out calls when a defined event must be automatically reported.

5.4.2: Hardware Connection

When the INP2 Option is ordered, there are two RJ11 jacks that pigtail from the back of the meter (1- Line connection for the outside line; 2 - Phone connection for your phone). A standard telephone RJ11 plug connects the meter to a standard PSTN (Public Switched Telephone Network). The phone jack is the override of the modem function when the phone is in use.

With the device configured with the INP2 Option, the meter has dial-in capability and provides remote access to other Modbus-based serial devices via the meter's RS485 Gateway over your phone line. The meter will recognize and respond to a Modbus Address of 1. With any other address, the command passes through the gateway and

becomes a virtual connection between the Remote Modbus Master and any Modbus Slave connected to the RS485 Gateway.

5.4.3: Dial-In Function

The modem continuously monitors the telephone line to detect an incoming call. When an incoming call is detected, the modem waits a user-set number of rings and then answers the call.

The modem can be programmed to check for a password on an incoming call. If the correct password is not provided, the modem hangs up on the incoming call. If several unsuccessful incoming call attempts are received in a set time period, the modem locks out future incoming calls for a user-set number of hours.

When an incoming call is successfully connected, the control of communications is passed to the calling software program. The modem responds to computer commands to download data or other actions authorized by the meter passwords.

Refer to the *Communicator EXT User Manual* for instructions on programming the modem.

5.4.4: Dial-Out Function

The Dial-Out Function (INP2) is intended to allow the meter to automatically report certain conditions without user intervention. The modem is normally polling the meter to determine if any abnormal or reportable conditions exist. The modem checks the following meter conditions and programmed events (set in Communicator EXT) to determine if a call should be placed.

- Are any meter set-point limits exceeded?
- Has the status of high-speed inputs changed?
- Has a waveform been recorded?
- Has a power quality event been recorded?
- Has a control output changed?
- Has the meter experienced a loss of control power?

- Is either history log approaching a full condition?
- Is the event log approaching a full condition?
- Is any other log approaching a full condition?
- Has the modem password failed?
- Has communication with the meter failed?

If any of the monitored events exist, the modem automatically initiates a call to a specified location to make a report or perform some other function. For log full conditions, the meter automatically downloads the log(s) that are nearing the full state. The modem can be programmed to call two different numbers to make the required reports: Primary and Backup.

The modem can be programmed with an ASCII string for identification purposes. If this string in present the modem plays the string to the host computer upon connection to identify the meter to the host software. Refer to the *Communicator EXT User Manual* for programming details.

The modem includes a connection for an external 3V Lithium Battery (with custom leads and velcro mounting) to power the modem if the meter loses control power. Using the battery, the modem is able to complete a reporting call even if power to the meter has been disconnected. This feature allows the meter to report power outage conditions. Under normal conditions, the battery should provide in excess of 10 years of service during storage conditions (disconnected from terminals) or when properly installed in an energized meter. The battery should provide more than one year of service during outage conditions (on battery backup). A LOW BATTERY indicator appears on the display screen when battery power is low. Call the factory for a replacement battery.

Replacement of the battery is simple. When ordered, the battery is attached to a cable which pigtails from the back of the meter with a connector (see following NOTE, Figure 6.2, and Table 6.1).

Installation steps:

1. Remove the old battery by disconnecting it at the connector.

2. Install the new battery by snapping it into the connector.

3. Peel and stick the velcro adhesive somewhere outside the meter (or use the old adhesive to fasten the battery in place).

NOTE: Custom leads and Velcro mounting are not included in some earlier versions of the Switchboard Meter. Call the EIG factory for installation/replacement part BATT4384.

5.5: INP200 Onboard Ethernet

The 10/100BaseT Ethernet option -INP200 - is a fully customizable web server that uses XML to provide access to real-time data via the Internet. EIG's name for this dynamic system is Total Web Solutions. The system incorporates a highly programmable network card with built-in memory that is installed in meters with the INP200 option. Each card can be programmed to perform extensive monitoring functions. The 100BaseT option is much faster than the 10BaseT option, which does not offer Total Web Solutions.

5.5.1: Hardware Overview

A Nexus® 1262/1272 meter with the 10/100BaseT Ethernet Option (INP200) has all the components of the standard Nexus® meter plus the capability of connection to a network through an Ethernet LAN or through the Internet via Modbus TCP, DNP3 WAN/LAN, HTTP, SMTP, FTP, and/or DHCP.

The Internal Network Option of the Nexus® meter is an extremely versatile communication tool. It:

- Adheres to IEEE 802.3 Ethernet standard using TCP/IP
- Utilizes simple and inexpensive 100BaseT wiring and connections
- Plugs right into your network using the built-in RJ45 jack
- Is programmable to any IP address, subnet mask, and gateway requirements
- Communicates using the industry standard Modbus/TCP protocol or DNP3 WAN/LAN

5.5.2: Hardware Connection

Use standard RJ45 10/100BaseT cable to connect with the Nexus® meter. The RJ45 line is inserted into the RJ45 port coming from the back of the meter with the INP200 Ethernet Option (see Figure 6.2).

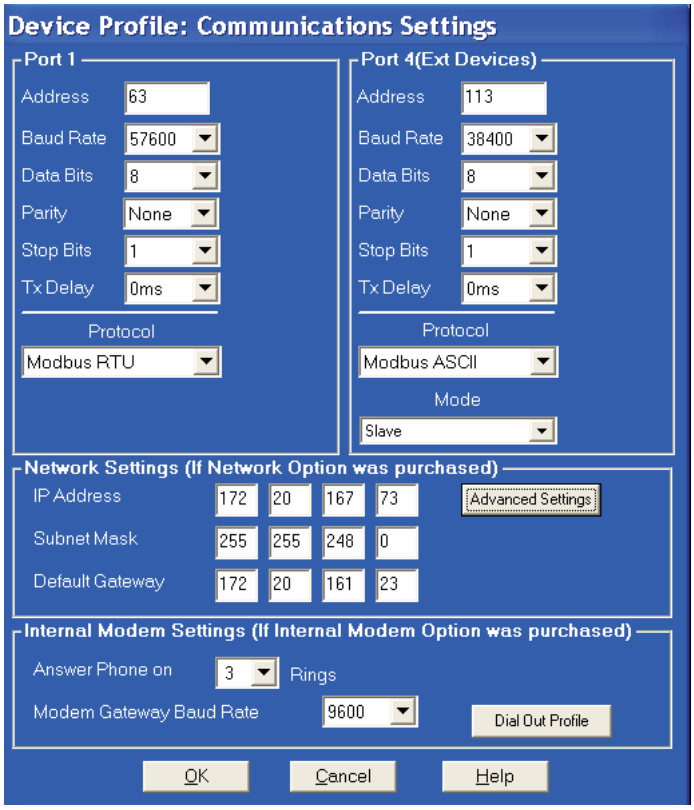
Configure the Network settings using the following steps:

1. Using Port 1, Port 4 (RS485 connection), or the optical port, connect a PC to the meter. An RS232/RS485 converter may be required (e.g., Electro Industries Unicom 2500).
2. Double-click on Communicator EXT Software to open it.
3. Click the **Quick Connect** or **Connection Manager** icon in the icon tool bar.
4. Click the **Serial Port** button. Make sure data matches the meter, then click **Connect**.

Set the Network using the following steps:

1. From the Device Profile menu, click **General Settings>Communications**> and then click on one of the listed ports.

2. You will see the Device Profile Communications Settings screen.



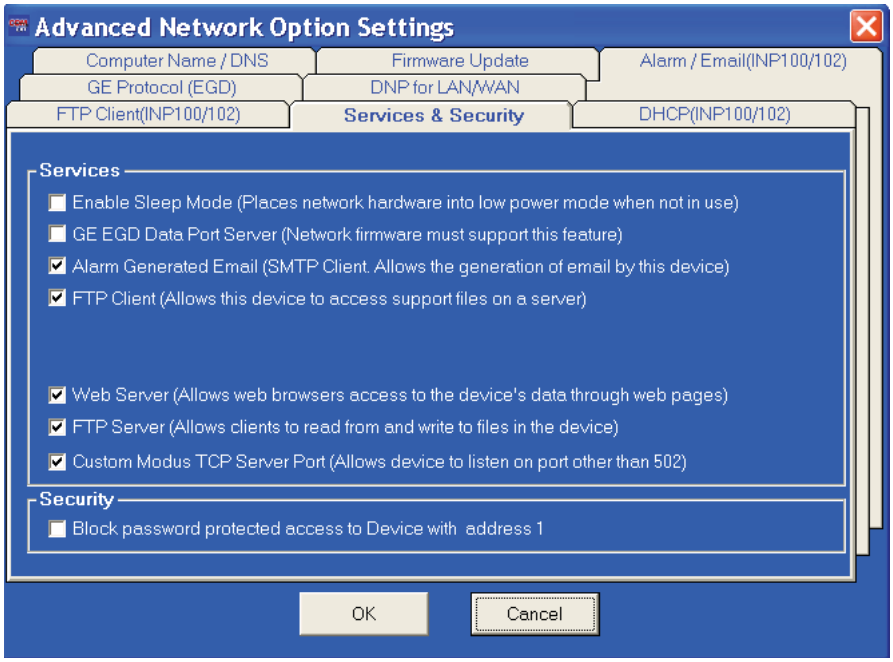
In the Network Settings section (middle of the screen), enter the following data provided by your Systems Administrator:

IP Address: 10.0.0.1 (Example)

Subnet Mask: 255.255.255.0 (Example)

Default Gateway: 0.0.0.0 (Example)

3. Click the **Advanced Settings** button to further configure the Network connection. The Advanced Network Option Settings screen opens.


Advanced Network Option Settings
Computer Name / DNS
Firmware Update
Alarm / Email(INP100/102)
GE Protocol (EGD)
DNP for LAN/WAN
FTP Client(INP100/102)
Services & Security
DHCP(INP100/102)
Services
Enable Sleep Mode (Places network hardware into low power mode when not in use)
GE EGD Data Port Server (Network firmware must support this feature)
Alarm Generated Email (SMTP Client. Allows the generation of email by this device)
FTP Client (Allows this device to access support files on a server)
Web Server (Allows web browsers access to the device's data through web pages)
FTP Server (Allows clients to read from and write to files in the device)
Custom Modus TCP Server Port (Allows device to listen on port other than 502)
Security
Block password protected access to Device with address 1
OK
Cancel

The tabs at the top of the screen let you navigate between settings. Depending on your meter's configuration, you may not need to program all of the settings shown here.

a. The first tab is Services & Security, shown above. Click the options to enable them for the Network option, e.g., to enable the Web server, click the box next to that option.

b. Click any of the other tabs to configure more options (see Chapter 4 in the *Communicator EXT User Manual* for detailed instructions):

- FTP Client: configure the FTP server settings
- GE Protocol (EGD): configure GE's EGD protocol (if the meter's firmware supports this)
- Alarm/Email: configure the alarm email notification settings
- Computer Name/DNS: set a name/DNS servers
- DHCP: enable DHCP functionality

- Firmware Update: update the Network card's firmware
- DNP for LAN/WAN: configure the settings for DNP3 LAN/WAN (DNP over the Ethernet)

c. Click **OK** to save your settings and close the Advanced Network Option Settings screen.

4. Click **OK** to save your communication settings and close the Communications Settings screen.

5. Click **Update Device** to send the new profile to the meter.

After the Network parameters are set, Communicator EXT connects to the meter via the Network using a Device Address of "1" and the assigned IP Address. Follow these steps:

1. Double-click on the Communicator EXT icon to open the software.

2. Click the **Connect** icon in the icon tool bar.

3. You will see the Connect screen. Click the **Network** button at the top of the screen. The screen will change to one requesting the following information:

Device Address:	1
Host:	IP Address (per your network administrator).
	Example: 10.0.0.1
Network Port:	502
Protocol:	Modbus TCP

NOTE: See Section 5.7 for the factory settings.

4. Click the **Connect** button at the bottom of the screen. Communicator EXT connects to the meter via the Network.

NOTES:

- Communicator EXT always communicates via Modbus TCP, which is the default protocol for Nexus® meters.

- See the *Communicator EXT User Manual* for more details on the Network option and the Web server (Total Web Solutions).

5.6: INP202 Ethernet/Modem Combination

The INP202 Option is an extension of INP200. It has all the features of INP200 plus a built-in modem. The communication protocol supported by the modem is Modbus ASCII. The communication protocol supported by the RS485 Ethernet/Modem Gateway is Modbus RTU.

INP202 converts all incoming Modem Modbus ASCII requests to Modbus RTU for internal and gateway communication. It then converts all response Modbus RTU messages into Modbus ASCII and sends the responses to the modem.

5.6.1: Hardware Overview

The Nexus® 1262/1272 meter with the INP202 Option has all the components of an INP200 Nexus® meter plus a built-in modem. It has the capability of connecting to a network through an Ethernet LAN and with other devices via modem.

5.6.2: Hardware Connection

There are three cables to connect for the INP202 Option. An RS485 Gateway cable, an RJ45 Ethernet cable and an RJ11 Modem cable are inserted into the cables coming from the back of the Nexus® meter with the INP202 Ethernet/Modem Option. Refer to Figure 6.2 for details on cables.

Make the software connection using the following steps:

1. Using Port 1 or Port 4 (RS485 connection), connect a PC to the meter. An RS232/RS485 converter may be required (e.g., Electro Industries' Unicom 2500).

2. Double-click on Communicator EXT Software to open it.

3. Click the **Quick Connect** or the **Connection Manager** icon in the icon tool bar.

4. Click the **Serial Port** button. Make sure data matches the meter, then click **Connect**.

Set the Network using the following steps:

(Refer to Section 4.3.5 of the *Communicator EXT User Manual* for more details).

1. From the Device Profile menu, click **General Settings>Communications**> and then click on one of the listed ports.

2. You will see the Device Profile Communications Settings screen. In the Network Settings section, enter data provided by your systems manager:

   IP Address: 10.0.0.1 (Example)

   Subnet Mask: 255.255.255.0 (Example)

   Default Gateway: 0.0.0.0 (Example)

   Computer Name: NETWORK (Example)

After the Network parameters are set, Communicator EXT connects to the meter via the Network using a Device Address of "1" and the assigned IP Address. Follow these steps:

1. Double-click on the Communicator EXT icon to open the software.

2. Click the **Connect** icon in the icon tool bar.

3. You will see the Connect screen. Click the **Network** button at the top of the screen. The screen will change to one requesting the following information:

   Device Address: 1

   Host: IP Address (per your network administrator).

   Example: 10.0.0.1

   Network Port: 502

   Protocol: Modbus TCP

   NOTE: See Section 5.7 for the factory settings.

4. Click the **Connect** button at the bottom of the screen. Communicator EXT connects to the meter via the Network.

5. For the Modem connection, follow the instructions in Section 5.4.

5.7: Factory Settings

You can use Communicator EXT to connect to a meter with the INP200/INP202 option for the first time, or at any time until the settings are changed, using the following factory settings:

Device Address: 1

IP Address: 10.0.0.1

Network Port: 502

Protocol: Modbus TCP

This page intentionally left blank.

6: Hardware Installation

6.1: Mounting the Nexus® Socket Meter

The Nexus® 1262/1272 Socket meter is designed to mount into a standard meter socket. Follow the Installation Summary below or follow the installation instructions on the meter socket to ensure that the unit is installed securely. See Dimension figures below and on the following pages.

NOTE: For Switchboard Meter dimensions and related information, see Chapter 12.

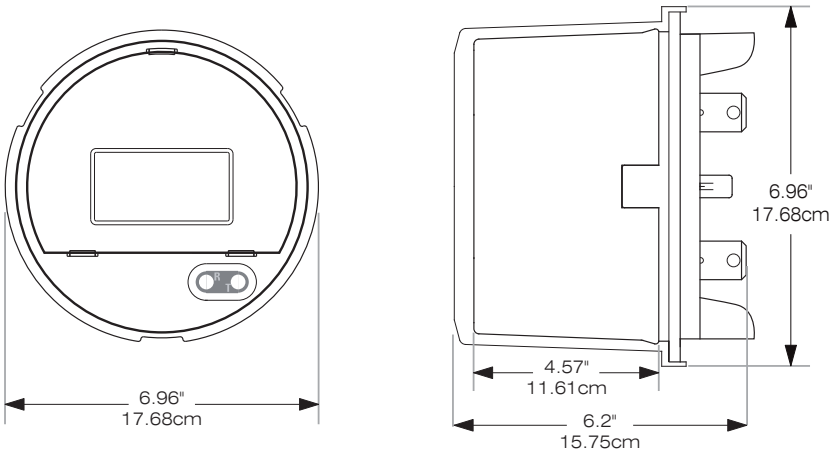


Figure 6.1: Socket Meter Mounting Dimensions

Installation Summary

- Examine the labels to verify that the meter you are installing is, in fact, the correct form factor and service type. Make sure that the socket and meter current class ratings are compatible.
- Make sure that all communication and auxiliary power wiring is accessible in case disconnection is required for any reason.
- Before applying power to the meter, install batteries if not installed at the factory and check the connections if they are installed. The meter has two batteries: an Internal battery which is used to maintain non-volatile readings and the real-time clock, and the Dial-out Modem battery, which is used by the INP2 option to dial out on an outage.

WARNING! POWER MUST BE OFF TO INSTALL THE INTERNAL BATTERY!

- To install the Internal Battery, remove the Internal Shroud and place the battery into the battery compartment with the + facing UP. Replace the Internal Shroud. See Section 6.2.

- To install the Modem Battery, with the Outer Shroud on the meter, locate the battery cable at the back of the meter and insert the cable connector into the cable. Use the velcro (peel and stick) to attach the battery somewhere outside of the meter. See Section 5.4.4.

- Measure the enclosure to make sure it accommodates the meter. (If it is standard size, that won't be necessary.)

- Make sure that any communications wiring from the back of the meter is fed through the appropriate openings in your socket to allow for clean connections with external devices.

- Insert the meter into the socket, making sure that the unit blades are firmly within the jaws of the socket.

- Connect external devices to the appropriate communications wiring. See following Figure 6.2 and Table 6.1, Cable Color Key, for communications wiring details. RJ11 and RJ45 connectors are supplied.

- Make sure the meter is functioning properly by running it through a test circuit.
- The Nexus® Socket meter has its own display built into the face of the meter. However, you may want to install additional displays in remote locations. See Section 6.3 for installation procedures for the Nexus® P40N/P40N+/P41N+/P43N+ displays. The displays are connected to the meter via the RS485 cable supplied with the 1262/1272 (see Figure 6.2, below). See Chapter 5 for detailed wiring instructions.

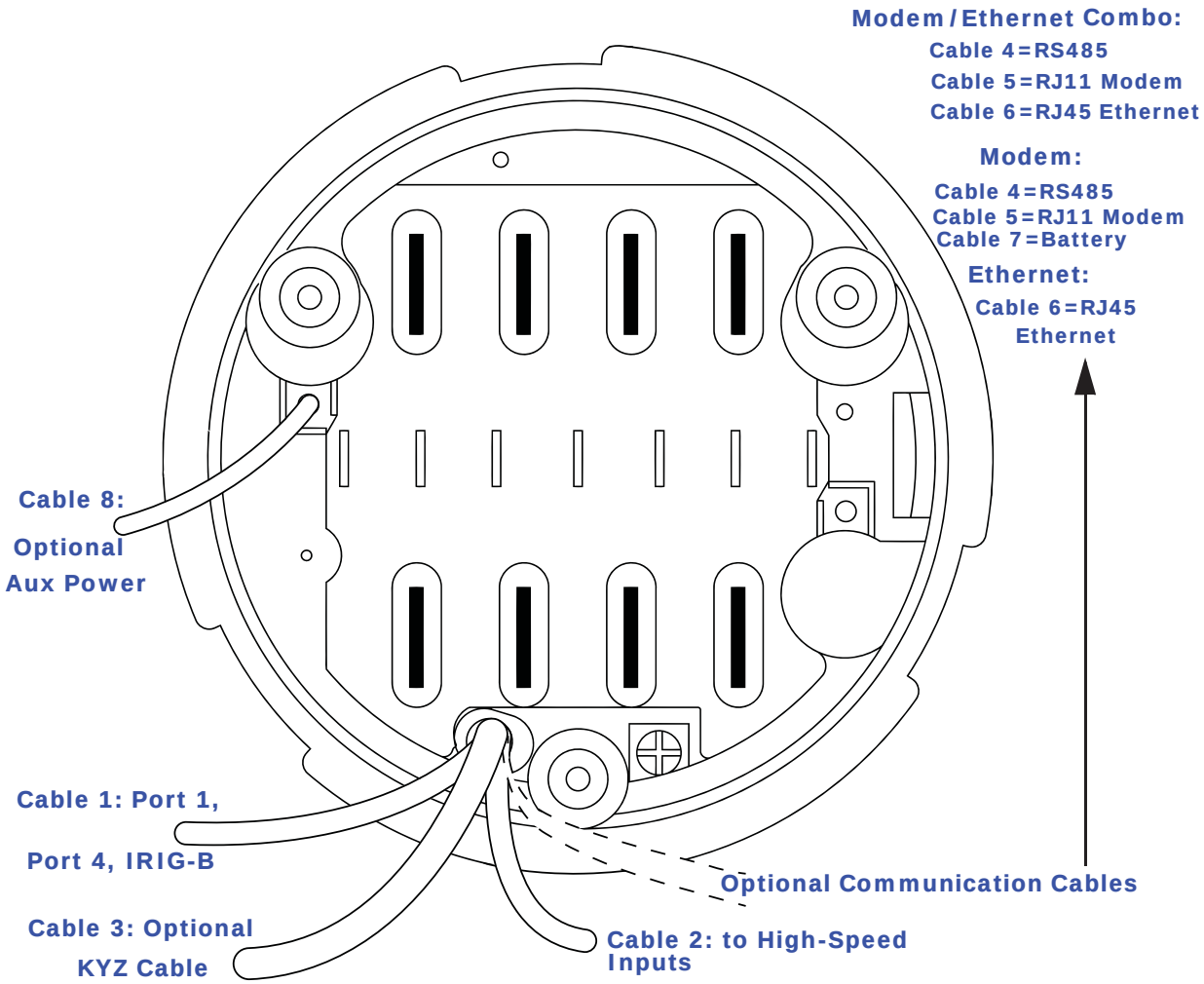


Figure 6.2: Socket Meter Rear View Showing Cables

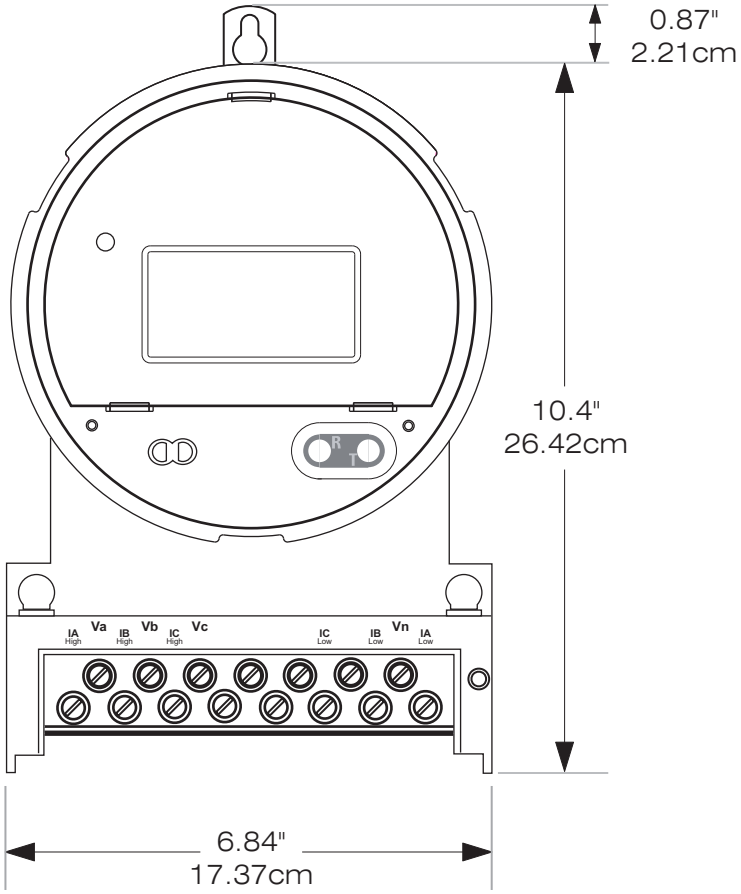


Figure 6.3: Socket Meter Mounted in A-Base Front View

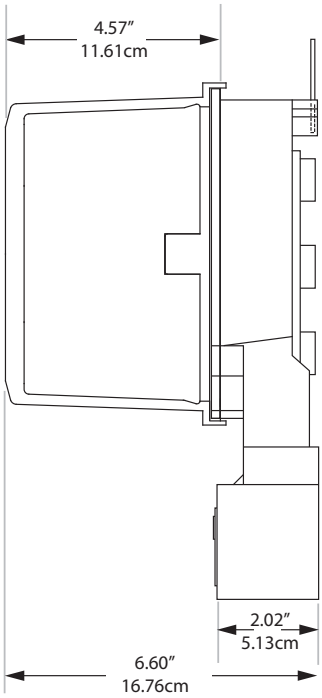


Figure 6.4: Socket Meter in A-Base Side View

6.1.1: Cable Color Key

Cable	Signal Name	Color
Cable 1	**Port 1 Wiring (RS485)**	
	SHIELD	Black
	Tx/Rx+	Brown
	Tx/Rx-	Red
	Port 4 Wiring (RS485)	
	SHIELD	Orange
	Tx/Rx+	Yellow
	Tx/Rx-	Green
	IRIG-B	
	+	Blue
	-	Purple

Cable	Signal Name	Color
Cable 2	**High-Speed Inputs**	
	Input 8	Black
	Input 7	Brown
	Input 6	Red
	Input 5	Orange
	Input 4	Yellow
	Input 3	Green
	Input 2	Blue
	Input 1	Gray
	Common	Purple
Cable 3	**Optional KYZ Output**	
	Normally Closed 1	Black
	Common	Brown
	Normally Open 1	Red
	Normally Closed 2	Orange
	Common	Yellow
	Normally Open 2	Green
	Normally Closed 3	Blue
	Common	Purple
	Normally Open 3	Gray
	Normally Closed 4	Light Green
	Common	Pink
	Normally Open 4	White
Cable 4	**RS485**	
	SHIELD	Blue
	Tx/Rx+	Green
	Tx/Rx-	Red
Cable 5	**RJ11 Modem**	
	Label Attached	Blue

Cable	Signal Name	Color
Cable 6	**RJ45 Ethernet**	
	Label Attached	Blue
Cable 7	**Battery**	
	Label Attached	Black
Cable 8	**Aux Power - DE**	
	Positive	Red
	Neutral/Negative	Black
	Aux Power - SE	
	Positive	Black
	Neutral/Negative	Black

Table 6.1: Cable Color Key

IMPORTANT NOTE! The Cable colors shown here are subject to change without notice. Refer to the CABLE LABELS for color code verification.

6.2: Internal Battery Installation and Maintenance

CAUTION! - BATTERY INSTALLATION OR REPLACEMENT MUST BE DONE WITH POWER OFF!

Depending on its age, the Nexus® 1262/1272 meter could be equipped with either of two types of batteries:

- Older meters are equipped with 3V Lithium cell 2032.
- Meters shipped after February, 2010 are equipped with 3V Lithium cell Panasonic BR3032.

Examine the specific meter and be sure to install the correct battery.

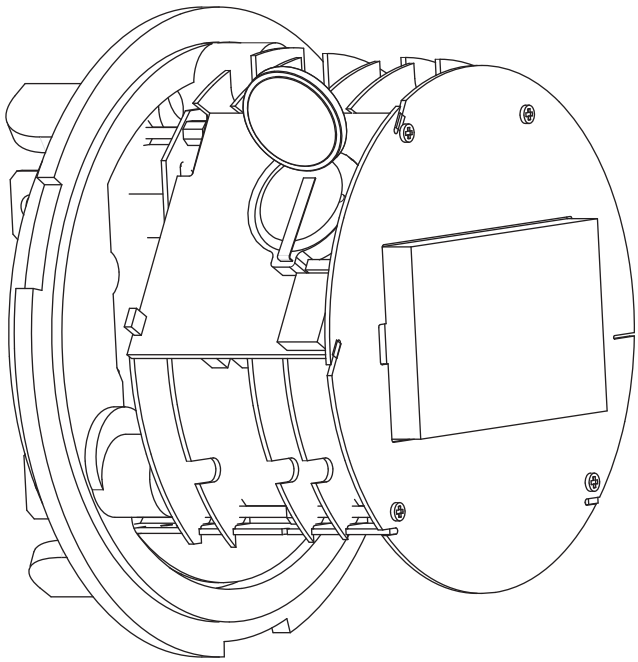


Figure 6.5: Meter without Internal Shroud

The Internal battery maintains NVRAM and time during outages. It is located on one of the vertical panels inside the Internal Shroud (see Figure 6.5). Under normal conditions, the battery should provide in excess of 10 years of service during storage conditions (disconnected from terminals) or when properly installed in an energized meter. The battery should provide more than one year of service during outage conditions (time on battery backup). A LOW BATTERY indicator on the display screen tells you when replacement is needed.

Follow these steps to install the battery:

1. Before replacing the battery, download all memory files to your computer, as data may be lost.

2. Remove power from the meter.

3. Remove the external meter cover and the internal shroud.

4. Remove the old battery with a screwdriver or similar tool.

5. Place the new battery in the battery holder.

   IMPORTANT! You must insert the replacement battery into the holder correctly. Otherwise proper contact will not be achieved and the meter may lose log memory and time functions.

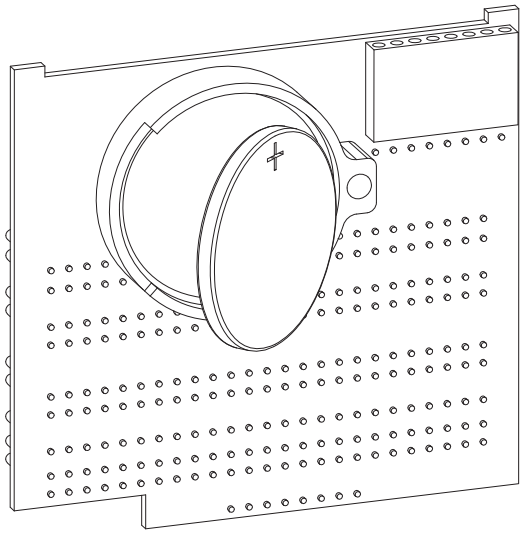


Figure 6.6: Battery Holder Detail

   a. Make sure the + on the battery is facing UP and toward you.

   b. Insert the RIGHT SIDE of the battery UNDER the 2 clips on the right side of the holder while gently pushing the battery against the INSIDE RIGHT WALL of the battery holder (Side A in Figure 6.6).

   c. Gently push the LEFT SIDE of the battery in until it snaps into place (Side B in Figure 6.6).

6. Replace the internal shroud and the external meter cover.

7. Power up the meter.

8. Reset meter time using Communicator software, unless IRIG-B is connected. (If IRIG-B is connected, time is synchronized automatically.)

NOTE: Replacement of the Modem Battery is explained in Section 5.4.4.

6.2.1: Battery Safety and Disposal

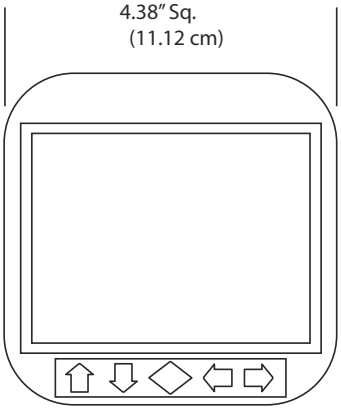
Dispose of batteries in accordance with local, state and federal hazardous waste regulations. For disposal outside the United States, follow your country's disposal guidelines.

6.3: Mounting the Optional External Displays

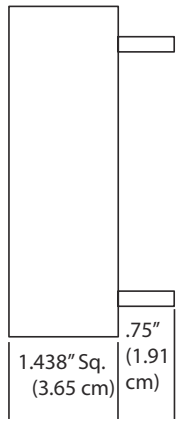
The Nexus® 1262/1272 meter has its own LCD Display on the meter face. The optional Nexus® LED Displays: P40N+, P41N+ and P43N+ (as well as the legacy P40N) may be used where additional displays are desired. The dimensions of the P40N and P40N+ are different - see the figures on the next page. The display mounts using a standard ANSI C39.1 drill plan. Secure the four mounting studs to the back of the panel with the supplied hardware. See Chapter 9 for details on the external displays.

Six feet of RS485 communication/power cable harness is supplied. Allow for at least a 1.25-inch (3.17cm) diameter hole in the mounting panel for the cable harness. See Chapter 5 for wiring details.

The display is powered by an external power source, such as the PSIO, which supplies 12 VDC.



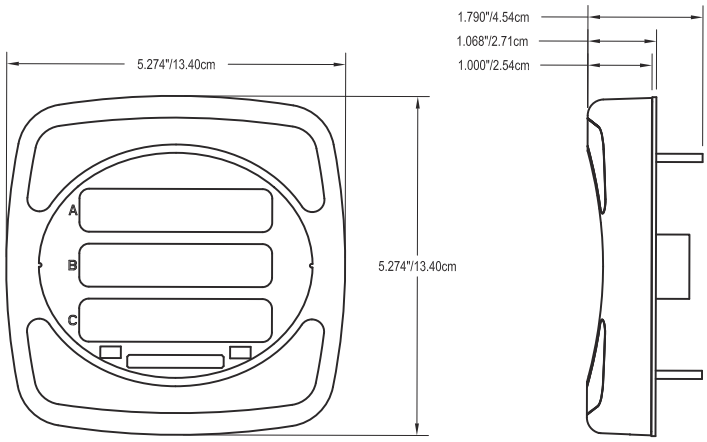
P40N Front Dimensions



P40N Side Dimensions

NOTE: The P40N is not intended for new applications.

Legacy P40N Dimensions



P40N+ Front and Side Dimensions

Figure 6.6: P40N/P40N+ Mounting Dimensions

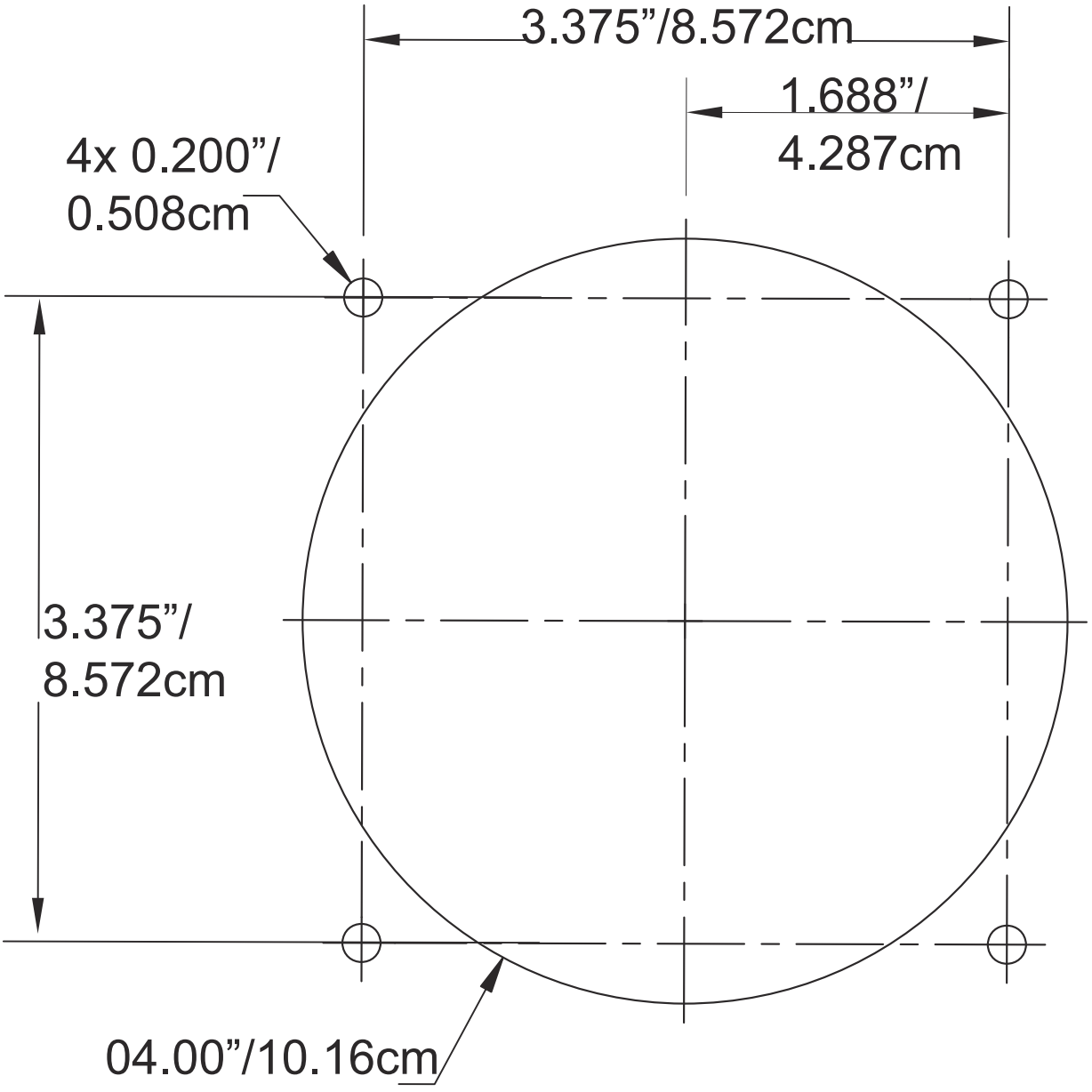


Figure 6.7: P40N/P40N+ ANSI Mounting

6.4: Mounting the Nexus® External I/O Modules

Connect multiple I/O modules by inserting male RS485 side ports into female side ports, then screw each module into the next, using a flathead screwdriver. Work from left to right.

Secure the mounting brackets to both ends of a group of I/O modules or both sides of an individual module, using the screws supplied (#440 pan-head screws). Next, secure the brackets to a flat surface using a #8 screw with a lock washer.

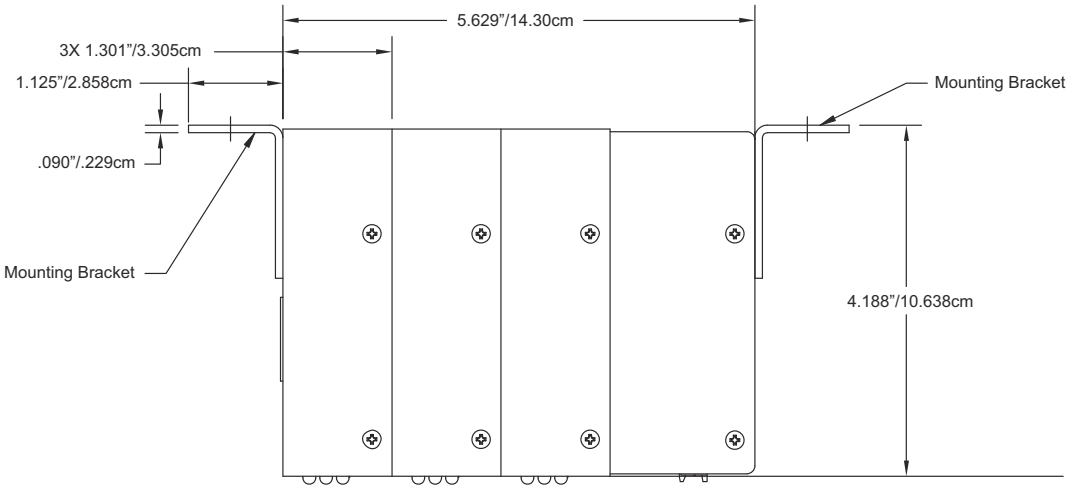


Figure 6.8: I/O Modules Mounting Diagram, Overhead View

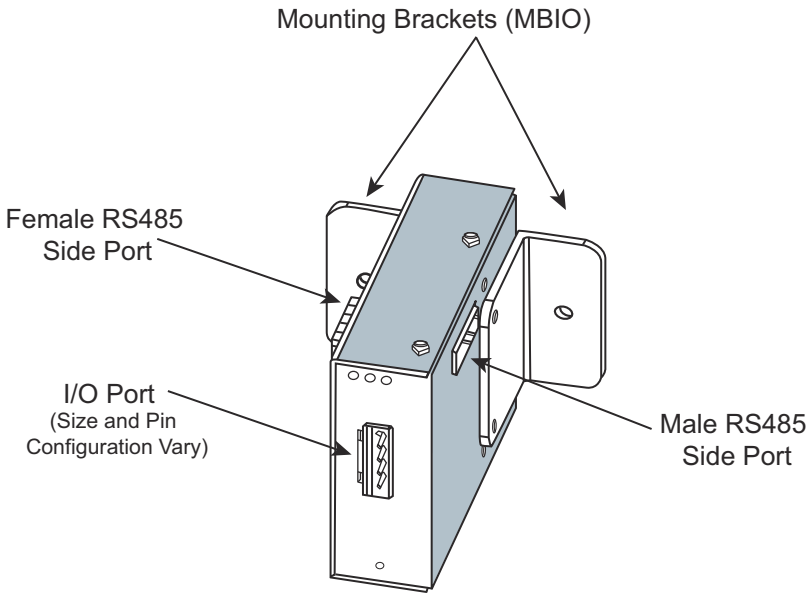


Figure 6.9: Single I/O Module with Mounting Brackets

IMPORTANT! The Nexus® 1262/1272 meter does not supply power to the I/O modules. You must use an external power supply, such as the EIG PSIO (12V Output). Figure 6.11 shows mounting with the PSIO.

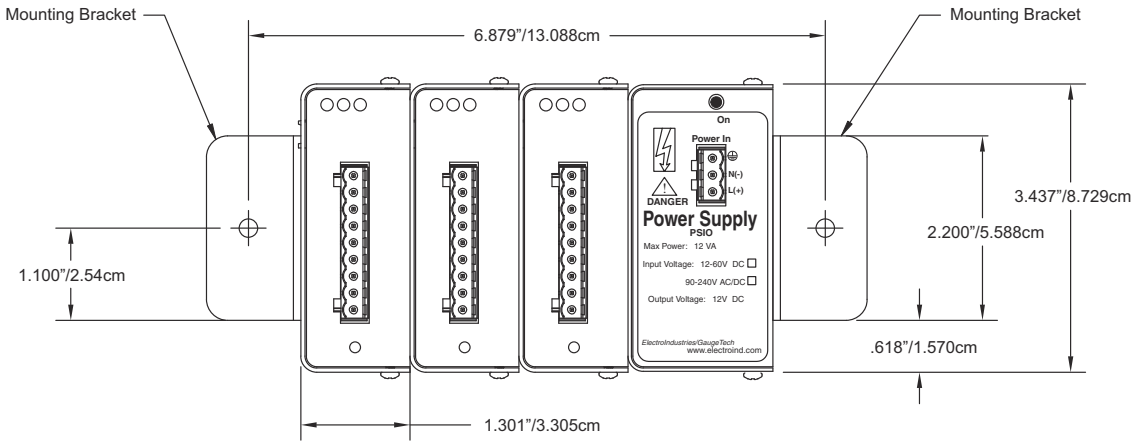


Figure 6.10: I/O Modules Mounting Dimensions, Front View

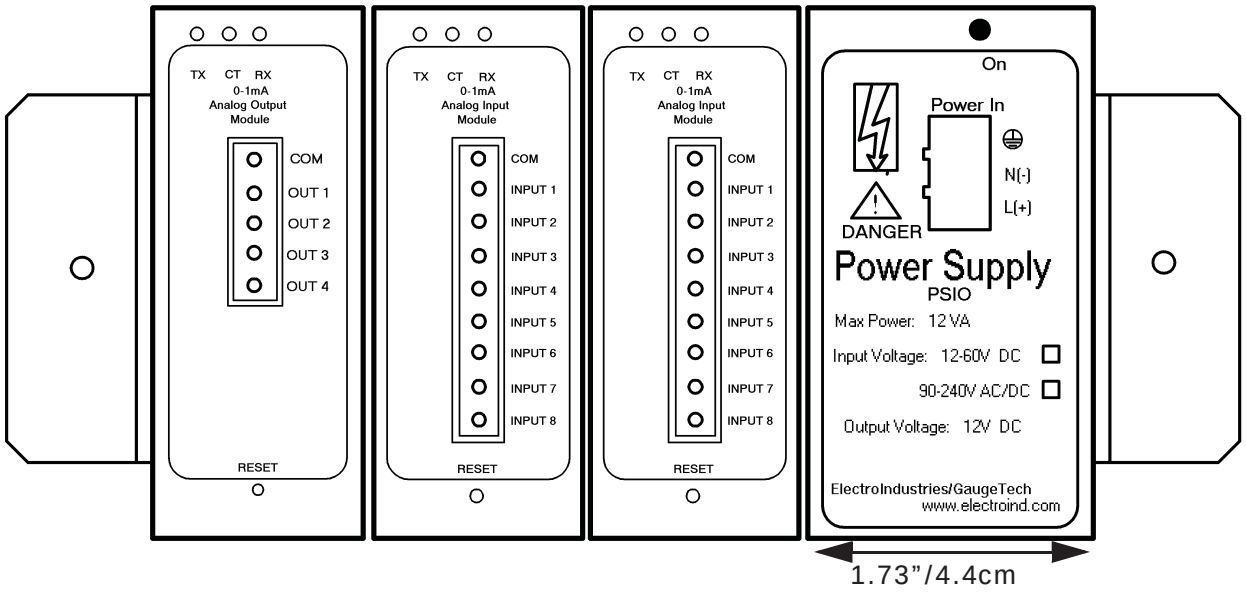


Figure 6.11: I/O Modules with PSIO Power Supply

Refer to Figure 6.12 and Section 5.3.8 for PSIO and I/O Module wiring instructions.

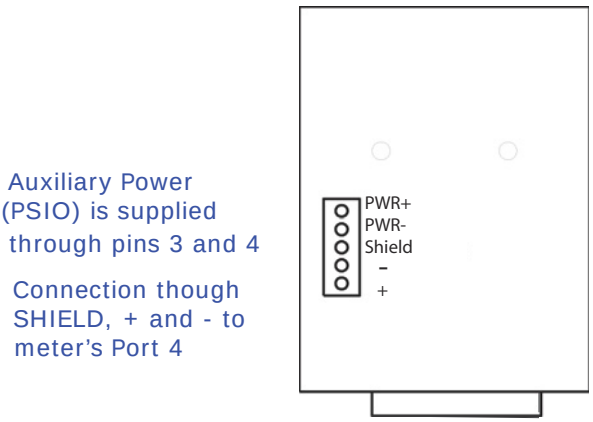


Figure 6.12: I/O Module Wiring Detail

This page intentionally left blank.

7: Time-of-Use Function

7.1: Introduction

A Time-of-Use (TOU) usage structure takes into account the quantity of energy used and the time at which it was consumed. The Nexus® 1262/1272 meter's TOU function, available with the Communicator EXT software, is designed to accommodate a variety of programmable rate structures. The TOU function accumulates data based on the time-scheme programmed into the Nexus® meter.

See the *Communicator EXT User Manual* for details on programming the Nexus® 1262/1272 meter's TOU calendar and retrieving TOU data.

7.2: The Nexus® Meter's TOU Calendar

A Nexus® meter's TOU calendar sets the parameters for TOU data accumulation. You may store up to twenty calendars in the Nexus® Meter and an unlimited amount of calendar files on your computer.

The TOU calendar profile allows you to assign a programmable usage schedule—eg, "Weekday," "Weekend," "Holiday"—to each day of the calendar year. You may create up to 16 different TOU schedules.

Each TOU schedule divides the 24-hour day into fifteen-minute intervals from 00:00:00 to 23:59:59. You may apply one of eight different programmable registers—eg "Peak," "Off Peak," "Shoulder Peak"— to each fifteen-minute interval.

The Nexus® meter stores:

- Accumulations on a seasonal basis, up to four seasons per year
- Accumulations on a monthly basis

Seasonal and monthly accumulations may span one year into the next. Each season and month is defined by a programmable start/billing date, which is also the end-date of the prior season or month.

A season ends at midnight of the day before the start of the next season.

A month ends at midnight of the month's billing day.

If the year ends and there is no new calendar, TOU accumulations will stop. If a calendar is present for the following year, TOU accumulations continue until the next monthly bill date or next start-of-season is reached. Accumulation can span into the following year.

If no following year is present, the last accumulation for the year will end on 12:31:23:59:59.

7.3: TOU Frozen and Active Registers

The Nexus® meter stores accumulations for the prior time periods. When the end of a billing period is reached, the Active period of time becomes stored as Frozen. The registers are then cleared and accumulations resume, using the next set of TOU schedules and register assignments from the stored calendar.

Frozen and Active Accumulations are always available.

7.4: Updating, Retrieving and Replacing TOU Calendars

Communicator EXT software retrieves TOU calendars from the Nexus® meter or from the computer's hard drive for review and edit.

Up to a maximum of twenty yearly calendars can be stored in the Nexus® meter at any given time. You may retrieve them one at a time; a new calendar can be stored while a current calendar is in use.

Accumulations do not stop during calendar updates. If a calendar is replaced while in use, the accumulations for the current period will continue until the set end date. At that point, the current time will become the new start time and the settings of the new calendar will be used.

Reset the current accumulations, if you replace a calendar in use. A reset clears only the current accumulation registers. This causes the current accumulations to use the present date as the start and accumulate to the next new end date, which will be taken from the new calendar. Once stored, prior accumulations are always available and cannot be reset. See the *Communicator EXT User Manual* for instructions on resetting TOU accumulations.

At the end of a defined period, current accumulations are stored, the registers are cleared and accumulations for the next period begin. When the year boundary is crossed, the second calendar, if present, is used. To retain continuity, you have up to one year to replace the old calendar with one for the following year.

7.5: Daylight Savings and Demand

To use Daylight Savings Time, you must enable it in the Nexus® meter's Device Profile, Time Settings. Click Auto DST, which sets Daylight Savings Time automatically (for the United States ONLY). You can also select User Defined and enter the desired dates for Daylight Savings Time. See Chapter 4 in the *Communicator EXT User Manual* for details.

- To set Demand Intervals, from the Device Profile select **Revenue & Energy Settings > Demand Integration Intervals** and set the desired intervals. Click **OK**.

- To set Cumulative Demand Type, from the Device Profile click **Revenue & Energy Settings > Cumulative Demand Type** and select Block or Rolling Window. Click **OK**.

This page intentionally left blank.

8: Transformer Line Loss Compensation

8.1: Introduction

The Edison Electric Institute's Handbook for Electricity Metering, Ninth Edition defines Loss Compensation as:

A means for correcting the reading of a meter when the metering point and point of service are physically separated, resulting in measurable losses including I2R losses in conductors and transformers and iron-core losses. These losses may be added to or subtracted from the meter registration.

Loss compensation may be used in any instance where the physical location of the meter does not match the electrical location where change of ownership occurs. Most often this appears when meters are connected on the low Voltage side of power transformers when the actual ownership change occurs on the high side of the transformer. This condition is illustrated in Figure 8.1.

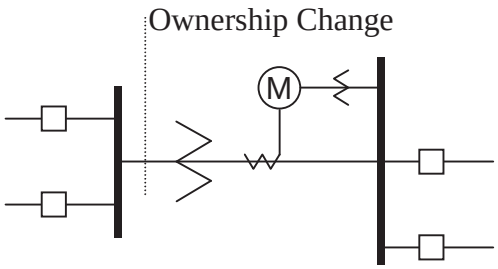


Figure 8.1: Low Voltage Metering Installation Requiring Loss Compensation

It is generally less expensive to install metering equipment on the low Voltage side of a transformer and in some conditions other limitations may also impose the requirement of low-side metering even though the actual ownership change occurs on the high Voltage side.

The need for loss compensated metering may also exist when the ownership changes several miles along a transmission line where it is simply impractical to install metering equipment. Ownership may change at the midway point of a transmission line where there are no substation facilities. In this case, power metering must again be compensated. This condition is shown in Figure 8.2.

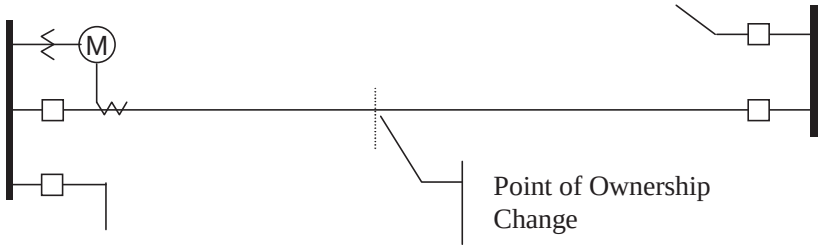


Figure 8.2: Joint Ownership Line Meeting Requiring Loss Compensation

A single meter cannot measure the losses in a transformer or transmission line directly. It can, however, include computational corrections to calculate the losses and add or subtract those losses to the power flow measured at the meter location. This is the method used for loss compensation in the Nexus® meter. Refer to Appendix A in this manual and Appendix B of the *Communicator EXT User Manual* for detailed explanation and instructions for using the Transformer Line Loss Compensation feature of the Nexus® 1262/1272 meter.

The computational corrections used for transformer and transmission line loss compensation are similar. In both cases, no-load losses and full-load losses are evaluated and a correction factor for each loss level is calculated. However, the calculation of the correction factors that must be programmed into the meter differ for the two different applications. For this reason, the two methodologies will be treated separately in this chapter.

In the Nexus® meter, Loss Compensation is a technique that computationally accounts for active and reactive power losses. The meter calculations are based on the formulas below. These equations describe the amount of active (Watts) and reactive (VARs) power lost due to both iron and copper effects (reflected to the secondary of the instrument transformers).

Total Secondary Watt Loss =

(((Measured Voltage/Cal point Voltage)2 x %LWFE) + ((Measured Current/Cal Point Current)2 x %LWCU)) x Full-scale Secondary VA

Total Secondary VAR Loss =

(((Measured Voltage/Cal point Voltage)4 x %LVFE) + ((Measured Current/Cal Point Current)2 x %LVCU)) x Full-scale Secondary VA

The Values for %LWFE, %LWCU, %LVFE, and %LVCU are derived from the transformer and meter information, as demonstrated in the following sections.

The calculated loss compensation values are added to or subtracted from the measured Watts and VARs. The selection of adding or subtracting losses is made through the meter's profile when programming the meter (see the following section for instructions). The meter uses the combination of the add/subtract setting and the directional definition of power flow (also in the profile) to determine how to handle the losses. Losses will be "added to" or "subtracted from" (depending on whether add or subtract is selected) the Received Power flow. For example, if losses are set to "Add to" and received power equals 2000 kW and losses are equal to 20kW then the total metered value with loss compensation would be 2020 kW; for these same settings if the meter measured 2000 kW of delivered power the total metered value with loss compensation would be 1980 kW.

Since transformer loss compensation is the more common loss compensation method, the meter has been designed for this application. Line loss compensation is calculated in the meter using the same terms but the percent values are calculated by a different methodology.

Nexus® meter transformer loss compensation:

- Performs calculations on each phase of the meter for every measurement taken; unbalanced loads are handled accurately.
- Calculates numerically, eliminating the environmental effects that cause inaccuracies in electromechanical compensators.
- Performs bidirectional loss compensation.
- Requires no additional wiring; the compensation occurs internally.
- Imposes no additional electrical burden when performing loss compensation.

Loss Compensation is applied to 1 second per phase Watt/VAR readings and, because of that, affects all subsequent readings based on 1 second per phase Watt/VAR readings. This method results in loss compensation being applied to the following quantities:

- Total Power
- Demands, per phase and total (Thermal, Block (Fixed) Window, Rolling (Sliding) Window and Predictive Window)
- Maximum and minimum Demands
- Energy accumulations
- KYZ output of Energy accumulations

NOTE: Loss Compensation is disabled when the meter is placed in Test Mode.

8.2: Nexus® 1262/1272 Meter's Transformer Loss Compensation

The Nexus® meter provides compensation for active and reactive power quantities by performing numerical calculations. The factors used in these calculations are derived either:

- By clicking the TLC Calculator button on the Transformer Loss screen of the Device Profile, to open the EIG Loss Compensation Calculator in Microsoft Excel
- By figuring the values from the worksheet shown here and in Appendix B of the *Communicator EXT User Manual*

Either way, you enter the derived values into the Communicator EXT software through the Device Profile Transformer and Line Loss Compensation screen.

The Communicator EXT software allows you to enable transformer loss compensation for losses due to copper and iron, individually or simultaneously. Losses can either be added to or subtracted from measured readings. Refer to Appendix B in the *Communicator EXT User Manual* for instructions.

Loss compensation values must be calculated based on the meter installation. As a result, transformer loss values must be normalized to the meter by converting the base Voltage and current and taking into account the number of elements used in the

metering installation. For three-element meters, the installation must be normalized to the phase-to-neutral Voltage and the phase current; in two-element meters the installation must be normalized to the phase-to-phase Voltage and the phase current. This process is described in the following sections.

8.2.1: Loss Compensation in Three Element Installations

Loss compensation is based on the loss and impedance values provided on the transformer manufacturer's test report. A typical test report will include at least the following information:

- Manufacturer
- Unit serial number
- Transformer MVA rating (Self-Cooled)
- Test Voltage
- No load loss watts
- Load loss watts (or full load loss watts)
- % Exciting current @ 100% Voltage
- % Impedance

The transformer MVA rating is generally the lowest MVA rating (the self-cooled or OA rating) of the transformer winding. The test Voltage is generally the nominal Voltage of the secondary or low Voltage winding. For three-phase transformers these values will typically be the three-phase rating and the phase-to-phase Voltage. All of the test measurements are based on these two numbers. Part of the process of calculating the loss compensation percentages is converting the transformer loss values based on the transformer ratings to the base used by the meter.

Correct calculation of loss compensation also requires knowledge of the meter installation. In order to calculate the loss compensation settings you will need the following information regarding the meter and the installation:

- Number of meter elements

- Potential transformer ratio (PTR)
- Current transformer ratio (CTR)
- Meter base Voltage
- Meter base current

This section is limited to application of Nexus® meters to three-element metering installations. As a result, we know that:

- Number of metering elements = 3
- Meter base Voltage = 120 Volts
- Meter base current = 5 Amps

8.2.1.1: Three-Element Loss Compensation Worksheet

Company		Station Name	
Date		Trf. Bank No.	
Trf Manf		Trf Serial No.	
Calculation by			

Transformer Data (from Transformer Manufacturer's Test Sheet)

Winding	Voltage	MVA	Connection
HV - High			Δ-Y
XV - Low			Δ-Y
YV - Tertiary			Δ-Y

Value	Watts Loss		
	3-Phase	1-Phase	1-Phase kW
No-Load Loss			
Load Loss			

Enter 3-Phase or 1-Phase values. If 3-Phase values are entered, calculate 1-Phase values by dividing 3-Phase values by three. Convert 1-Phase Loss Watts to 1-Phase kW by dividing 1-Phase Loss Watts by 1000.

Value	3-Phase MVA	1-Phase MVA	1-Phase kVA
Self-Cooled Rating			

Enter 3-Phase or 1-Phase values. If 3-Phase values are entered, calculate 1-Phase values by dividing 3-Phase values by three. Convert 1-Phase Self-Cooled MVA to 1-Phase kVA by multiplying by 1000.

% Exciting Current	
% Impedance	

Value	Phase-to-Phase	Phase-to-Neutral
Test Voltage (Volts)		
Full Load Current (Amps)		

Test Voltage is generally Phase-to-Phase for three-phase transformers. Calculate Phase-to-Neutral Voltage by dividing Phase-to-Phase Voltage by the square root of 3. Calculate Full Load Current by dividing the (1-Phase kW Self-Cooled Rating) by the (Phase-to-Neutral Voltage) and multiplying by 1000.

Meter/Installation Data

Instrument Transformers	Numerator	Denominator	Multiplier
Potential Transformers			
Current Transformers			
Power Multiplier [(PT Multiplier) x (CT Multiplier)]			

Enter the Numerator and Denominator for each instrument transformer. For example, a PT with a ratio of 7200/120 has a numerator or 7200, a denominator or 120 and a multiplier of 60 (7200/120 = 60/1).

Meter Secondary Voltage (Volts)	120
Meter Secondary Current (Amps)	5

Base Conversion Factors

Quantity	Trans-former	Multiplier	Trf IT Sec	Meter Base	Meter/Trf
Voltage				120	
Current				5	

For Transformer Voltage, enter the Phase-to-Neutral value of Test Voltage previously calculated. For Transformer Current, enter the Full-Load Current previously calculated. For Multipliers, enter the PT and CT multipliers previously calculated.

TrfIT Secondary is the Base Value of Voltage and Current at the Instrument Transformer Secondary of the Power Transformer. These numbers are obtained by dividing the Transformer Voltage and Current by their respective Multipliers. The Meter/Trf values for Voltage and Current are obtained by dividing the Meter Base values by the TrfIT Secondary values.

Load Loss at Transformer

No-Load Loss Watts (kW) = 1-Phase kW No-Load Loss = _____

No-Load Loss VA (kVA) = (%Exciting Current) * (1-Phase kVA Self-Cooled Rating) / 100 = (_____) * (_____) / 100

= _____ kVA

No-Load Loss VAR (kVAR) = SQRT((No-Load Loss kVA)2 - (No-Load Loss kW)2) = SQRT((_____)2 - (_____)2)

= SQRT((_____) - (_____))

= SQRT (_____) = _____

Full-Load Loss Watts (kW) = 1-Phase Kw Load Loss = _____

Full-Load Loss VA (kVA) = (%Impedance) * (1-Phase kVA Self-Cooled Rating) / 100 = (_____) * (_____) / 100

= _____ kVA

Full-Load Loss VAR (kVAR) = SQRT((Full-Load Loss kVA)2 - (Full-Load Loss kW)2) = SQRT((_____)2 - (_____)2)

= SQRT((_____) - (_____))

= SQRT (_____) = _____

Normalize Losses to Meter Base

Quantity	Value at Trf Base	M/T Factor	M/T Factor Value	Exp	M/T Factor w/Exp	Value at Meter Base
No-Load Loss kW		V		^2		
No-Load Loss kVAR		V		^4		
Load Loss kW		1		^2		
Load Loss kVAR		1		^2		

Enter Value at Transformer Base for each quantity from calculations above. Enter Meter/Trf Factor value from Base Conversion Factor calculations above. Calculate M/T Factor with Exponent by raising the M/T Factor to the power indicated in the "Exp" (or Exponent) column.

Calculate the "Value at Meter Base" by multiplying the (M/T Factor w/ Exp) times the (Value at Trf Base).

Loss Watts Percentage Values

Meter Base kVA = 600 * (PT Multiplier) * (CT Multiplier) / 1000

= 600 * (_____) * (_____) / 1000

= _____

Calculate Load Loss Values

Quantity	Value at Meter Base	Meter Base kVA	% Loss at Meter Base	Quantity
No-Load Loss kW				% Loss Watts FE
No-Load Loss kVAR				% Loss VARs FE
Load Loss kW				% Loss Watts CU
Load Loss kVAR				% Loss VARs CU

Enter "Value at Meter Base" from Normalize Losses section. Enter "Meter Base kVA" from previous calculation. Calculate "% Loss at Meter Base" by dividing (Value at Meter Base) by (Meter Base kVA) and multiplying by 100.

Enter calculated % Loss Watts values into the Nexus® meter using Communicator EXT software. Refer to Appendix B of the *Communicator EXT User Manual* for instructions.

This page intentionally left blank.

9: Using the External Displays

9.1: Overview

The Nexus® 1262/1272 Socket meters have a backlit LCD display built into the meter. In addition, Electro Industries offers an optional external display powered by an additional power supply (such as the PSIO). The P40N+ (and the legacy P40N) is an LED display that provides easy-to-use access to the information stored in the Nexus® meter.

Plug the Nexus® external display into the Port 1 or Port 4 wiring connection using the RS485 cable supplied (see Chapter 5 for wiring details). The display operates at 9600 baud. To use the display on another port, configure that port to operate at 9600 baud using Communicator EXT software; see the *Communicator EXT User Manual* for instructions.

9.2: Nexus® P40N/P40N+ LED External Display

The Nexus® P40N/P40N+ LED external display has three modes:

- Dynamic Readings Mode (sections 9.3 and 9.4)
- Nexus® Information Mode (sections 9.5 and 9.6)
- Display Features Mode (sections 9.7 and 9.8)

Each Mode is divided into Groups. Most Groups are further broken down into Readings.

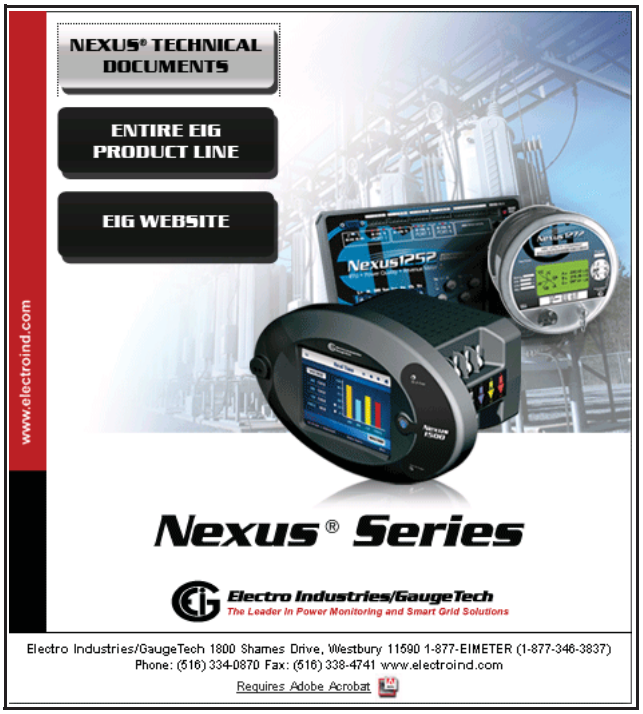
- Use the MODE button to scroll between Modes.
- Use the UP/DOWN arrows to scroll from Group to Group within each Mode.
- Use the LEFT/RIGHT arrows to scroll from Reading to Reading within each Group.

Use Communicator EXT software to Flash Update the P40N/P40N+ external display. See the *Communicator EXT User Manual* for instructions.

The Nexus® P40N+ LED external display has a USB port on the front for direct data downloads. You can connect to the USB port with Communicator EXT to poll and configure the meter attached to the display. To use the USB, follow these instructions:

1. Use the Nexus® Series Product CD, shipped with your meter, to install the Communicator EXT software and the driver for the P40N+ USB port.

   a. Insert the CD into your PC's CD drive. The screen shown below opens in your Browser.


NEXUS® TECHNICAL DOCUMENTS
ENTIRE EIG PRODUCT LINE
EIG WEBSITE
www.electroind.com
Nexus® Series
Electro Industries/GaugeTech
The Leader In Power Monitoring and Smart Grid Solutions
Electro Industries/GaugeTech 1800 Shames Drive, Westbury 11590 1-877-EIMETER (1-877-346-3837)
Phone: (516) 334-0870 Fax: (516) 338-4741 www.electroind.com
Requires Adobe Acrobat

   b. Click the **Nexus® Technical Documents** button. The following screen opens in your Browser.

c. To install Communicator EXT 3.0 software and the driver for the P40N+:

i. Click on the **Communicator EXT 3.0** button and click **Run** in the window that opens. The software is installed.

ii. Click on the **USB Driver** button click **Run** in the window that opens. The P40N+ driver is installed.

2. Connect the USB cable from your PC to the port: using a USA-A Male to USB-B Male cable, attach the USB-A connector to the PC and attach the USB-B connector to the P40N+ USB port. See Figure 6.1.

Figure 6.1: USB-B Male Connector and P40N+ USB Port

3. Once the USB cable is connected to the P40N+, the display clears and the message "USB in Use" scrolls at the bottom of the display. Additionally, the USB LED icon lights up when the USB connection is being used.

You connect to the USB port using Communicator EXT software the same way you connect to a meter with the software. Follow these instructions:

1. Determine which port the PC's USB is using:

   a. On your PC, click **Start>Settings>Control Panel**.

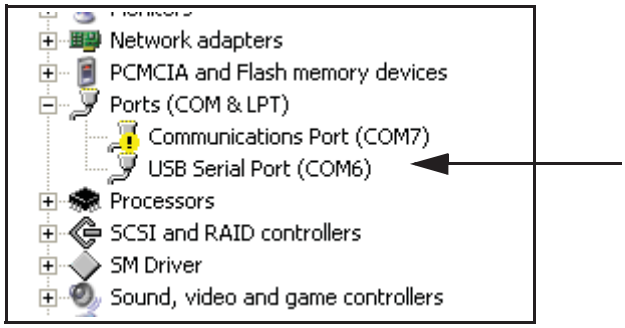
   b. Double-click the **System** folder.

   c. Click the **Hardware** tab. You will see the screen below.

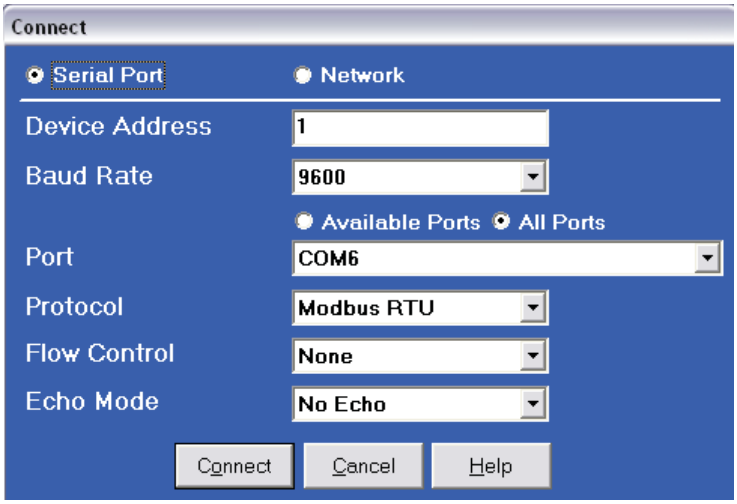
System Properties
System Restore
Automatic Updates
Remote
General
Computer Name
Hardware
Advanced
Device Manager
The Device Manager lists all the hardware devices installed on your computer. Use the Device Manager to change the properties of any device.
Device Manager
Drivers
Driver Signing lets you make sure that installed drivers are compatible with Windows. Windows Update lets you set up how Windows connects to Windows Update for drivers.
Driver Signing
Windows Update
Hardware Profiles
Hardware profiles provide a way for you to set up and store different hardware configurations.
Hardware Profiles
OK
Cancel
Apply

   d. Click the **Device Manager** button. You will see a list of the computer's hardware devices.

e. Click the plus sign next to Ports (COM & LPT). The COM ports are displayed. Note the COM number for the USB Serial Port. This is the number you will use to connect to the P40N+ through Communicator EXT. See the figure below.



2. Open Communicator EXT software and click the **Connect** icon in the Icon bar. See the screen shown below.



3. Click the **Serial Port** button if it's not already selected.

4. Set the Baud Rate to 9600. (It uses 9600 because it shares an existing Com port for displayed readings.)

5. Click the **Available Ports** button and select the USB COM Port number from the drop-down list.

6. Protocol should be Modbus RTU.

7. Flow Control should be None.

8. Echo Mode should be No Echo.

9. Click **Connect**. The software connects to the meter through the P40N+. Refer to the *Communicator EXT User's Manual* for programming instructions. (Click **Help>Contents** from the Communicator EXT Title Bar to view the manual online.)

9.3: Dynamic Readings Mode

The External Display puts itself in the Dynamic Readings Mode upon power-up. Use the MODE button to access the Dynamic Readings from other Modes. Use the UP/DOWN arrows to navigate from Group to Group within this Mode. See Section 9.4 for a Navigation map of the Dynamic Readings Mode.

Group 1: Phase to Neutral Voltages (Use the Left/Right arrows to access the following readings, in order.)

- Volts AN/BN/CN
- Maximum Volts AN/BN/CN
- Minimum Volts AN/BN/CN
- Volts AN/BN/CN %THD
- Volts AN/BN/CN Maximum %THD
- Volts AN/BN/CN Minimum %THD

Group 2: Phase to Phase Voltages (Use the Left/Right arrows to access the following readings, in order.)

- Volts AB/BC/CA
- Minimum Volts AB/BC/CA
- Maximum Volts AB/BC/CA

Group 3: Current (Use the Left/Right arrows to access the following readings, in order.)

- Current A/B/C

- Maximum Current
- Minimum Current
- Current %THD
- Current Maximum %THD
- Current Minimum %THD
- Current Calculated N/Measured N
- Maximum Current Calculated N/Measured N

Group 4: Watt/VAR (Use the Left/Right arrows to access the following readings, in order.)

- kWatt/kVAR
- Maximum +kWatt/+kVAR/CoIn kVAR
- Maximum -kWatt/-kVAR/CoIn kVAR
- Block (Fixed) Window Average Maximum +kWatt/+kVAR/CoIn kVAR
- Predictive Rolling (Sliding) Window Maximum +kWatt/+kVAR/CoIn kVAR

Group 5:VA/PF/Frequency (Use the Left/Right arrows to access the following readings, in order.)

- kVA/PF lag/Hz
- Maximum kVA/Hz
- Minimum kVA/Hz
- Maximum Quadrant 1 Total PF
- Minimum Quadrant 1 Total PF
- Maximum Quadrant 2 Total PF
- Minimum Quadrant 2 Total PF

- Maximum Quadrant 3 Total PF
- Minimum Quadrant 3 Total PF
- Maximum Quadrant 4 Total PF
- Minimum Quadrant 4 Total PF

Group 6: Delivered Energy (Use the Left/Right arrows to access the following readings, in order.)

- +kWatthr Quadrant 1+Quadrant 4 (Primary)
- +kVARhr Quadrant 1 (Primary)
- -kVARhr Quadrant 4 (Primary)

Group 7: Received Energy (Use the Left/Right arrows to access the following readings, in order.)

- -kWatthr Quadrant 2+Quadrant 3 (Primary)
- +kVARhr Quadrant 2 (Primary)
- -kVARhr Quadrant 3 (Primary)

Group 8: Accumulations (Use the Left/Right arrows to access the following readings, in order.)

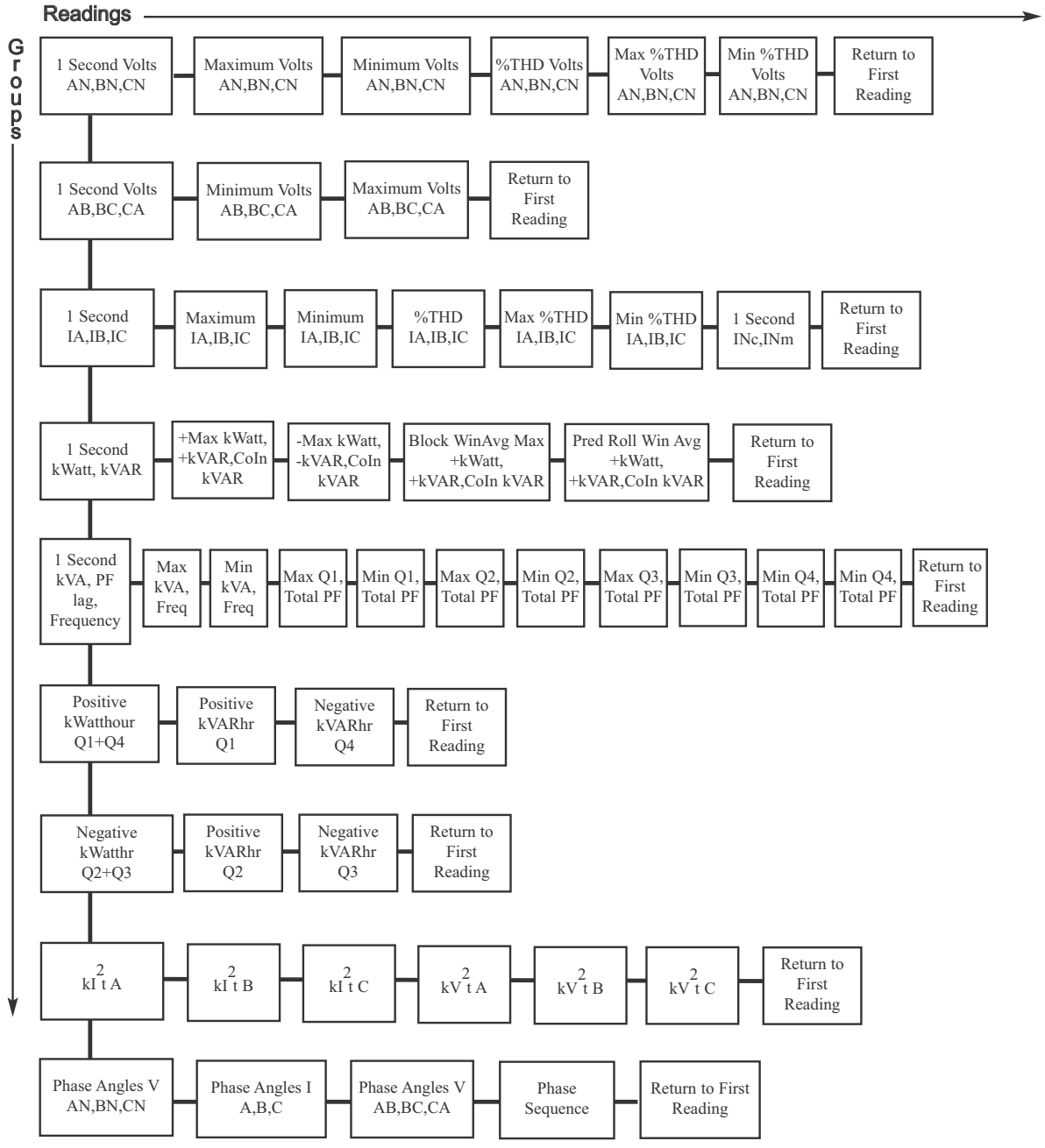
- kI2t A
- kI2t B
- kI2t C
- kV2t A
- kV2t B
- kV2t C

Group 9: Phase Angles (Use the Left/Right arrows to access the following readings, in order.)

- Phase Angle Van/bn/cn
- Phase Angle Ia/b/c
- Phase Angle Vab/bc/ca
- Phase Sequence

9.4: Navigation Map of Dynamic Readings Mode

- Use Left/Right arrow keys to navigate Readings
- Use Up/Down arrows to scroll between groups.



9.5: Nexus® Information Mode

Use the MODE button to access the Nexus® Information Mode from other Modes. Use the UP/DOWN arrows to navigate from Group to Group within this Mode. See Section 9.6 for a Navigation map of the Nexus® Information Mode.

Group 1: Device Time

Meter Time

Group 2: Communication Settings (Use the Left/Right arrows to access the following readings, in order.)

- Communication Settings Port 1: Baud/Addr/Protocol
- Communication Settings Port 2: Baud/Addr/Protocol
- Communication Settings Port 3: Baud/Addr/Protocol
- Communication Settings Port 4: Baud/Addr/Protocol

Group 3: PT/CT Ratios (Use the Left/Right arrows to access the following readings, in order.)

- PT Ratio
- CT Ratio

Group 4: External Display Units

Primary/Secondary:

Select either Primary or Secondary units for the External Display using the Communicator EXT software (see the *Communicator EXT User Manual*).

- When Primary is selected, the Display shows all readings in Primary units based on the user programmed PT and CT Ratios.
- When Secondary is selected, the Display shows all readings in Secondary units.

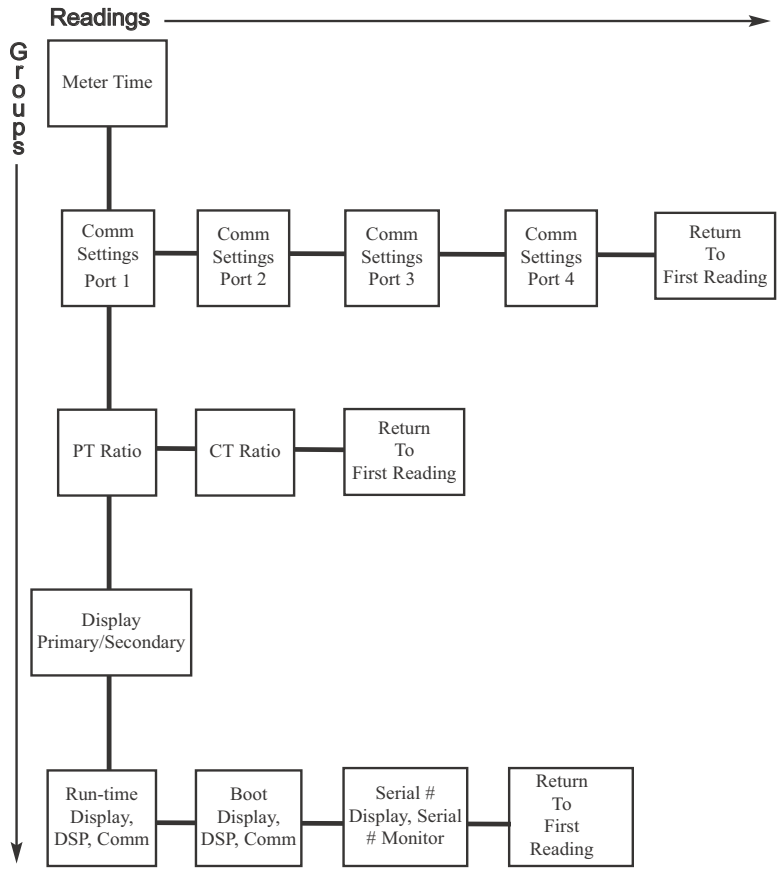
Group 5: Firmware Versions and Serial Numbers (Use the Left/Right arrows to access the following readings, in order.)

- Run Time External Display/Run Time DSP/RunTime Comm
- Boot External Display/Boot DSP/Boot Comm
- Serial Number External Display; Serial Number Nexus® Monitor

9.6: Navigation Map of Nexus® Information Mode

- Use Left/Right arrow keys to navigate Readings

Use Up/Down arrows to scroll between groups.



9.7: Display Features Mode

Use the Mode button to access the Display Features Mode from other modes. Use the Up/Down arrows to navigate from group to group within this mode. See Section 9.8 for a Navigation map of the Display Features mode.

Group 1: Reset Max/Min

Press **Enter** to reset the Max and Min values.

NOTE: If the Password Protection feature has been enabled through Communicator EXT software, you will need to enter a password to reset the Max/Min readings. Follow this procedure:

1. Press **Enter**.

2. Enter the password, one character at a time, by pressing the Up or Down arrows. (Each password character begins as an "A". Press the Up arrow to increment the character from "A-Z" and then from "0-9". Press the Down arrow to decrement the character from "A" to "9-0" and then from "Z-A".)

3. Press **Set** to enter each character in the password.

4. When the entire password is shown on the Display screen, press **Enter**.

5. Once the password is entered correctly, press **Enter** again to reset the Max/Min values.

Group 2: Reset Energy

Press **Enter** to reset the Energy readings.

NOTE: If the Password Protection feature has been enabled through Communicator EXT software, you will need to enter a password to reset the Energy readings. Follow steps 1-4, above. Then press **Enter** again to reset energy.

Group 3: Display Baud Rate/Address

Group 4: Display Communication Protocol

Group 5: EIG Use Only

Group 6: EIG Use Only

Group 7: Lamp Test

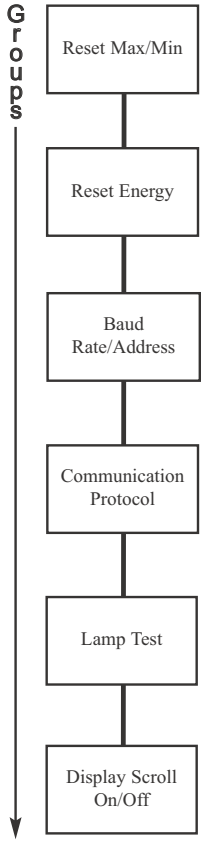
Press **Enter** to conduct an LED test.

Group 8: Display Scroll ON/OFF

Press **Enter** to turn the scroll feature on or off. When the scroll feature is on, the P40N+ external display scrolls through the first reading of each group in the Dynamic Readings mode. If a button is pressed during the scroll, scrolling pauses for one minute.

9.8: Navigation Map of Display Features Mode

Use Up/Down arrows to scroll between groups.



9.9: Optional P40N+ LED External Remote Display Specifications

Specification	P40N+/P41N+/P43N+ Displays
Maximum Input Voltage	30VDC
Minimum Input Voltage	12VDC
Maximum Power Consumption	5W
Nominal Power Consumption	Approximately 3W
Operating Temperature Range	(-20 to +70)^{o}C/(-4 to +158)^{o}F
Overall Dimensions (HxWxD)	*5.25 x 5.25 x 1.79 inches/13.34 x 13.34 x 4.54 cm

* The legacy P40N dimensions are: 4.4 x 4.4 x 2.2 inches/11.1 x 11.1 x 5.9cm.

This page intentionally left blank.

10: External I/O Modules

10.1: Hardware Overview

All Nexus® External I/O modules have the following components:

- Female RS485 Side Port: use to connect to another module's male RS485 side port.
- Male RS485 Side Port: use to connect to the Nexus® 1250/1252 Meter's Port 3 or 4 or to another module's female RS485 side port. See Section 5.3.8 for wiring detail.
- I/O Port: used for functions specific to the type of module; size and pin configuration vary depending on type of module.
- Reset Button: Press and hold for three seconds to reset the module's baud rate to 57600 and its address to 247 for 30 seconds.
- LEDs: when flashing, signal that the module is functioning.
- Mounting Brackets (MBIO): used to secure one or more modules to a flat surface.

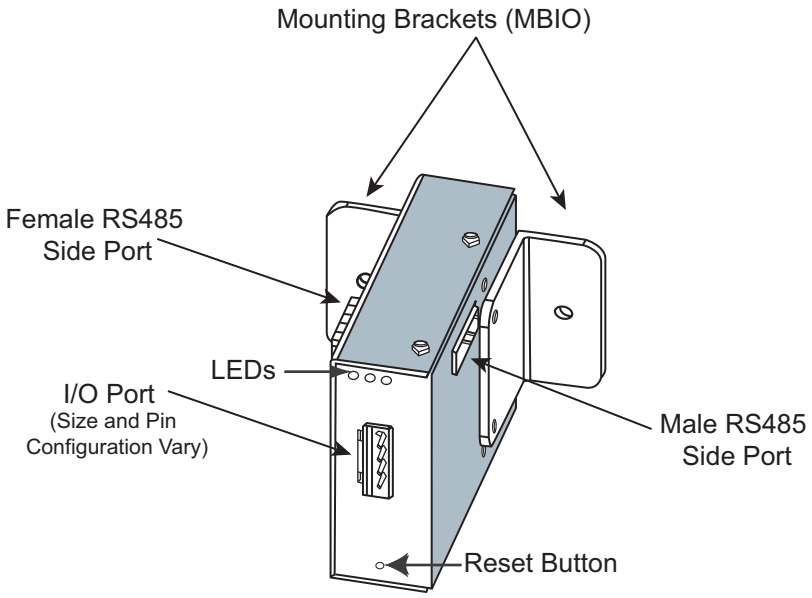
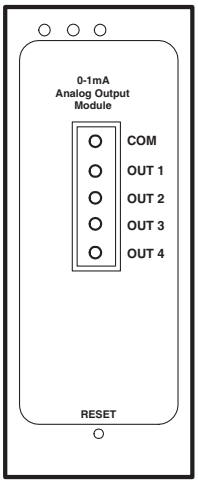


Figure 10.1: I/O Module Components

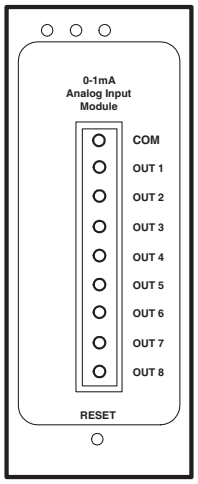
10.1.1: Port Overview

All Electro Industries I/O Modules have ports through which they interface with other devices. The port configurations are variations of the four types shown below.

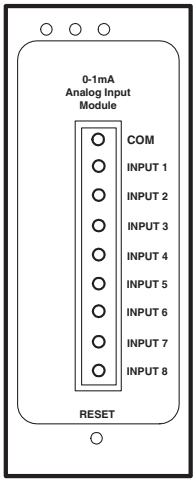
Four Analog Outputs (0-1mA and 4-20mA)



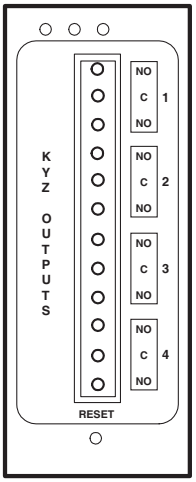
Eight Analog Outputs (0-1mA and 4-20mA)



Eight Analog Inputs (0-1mA, 0-20mA, 0-5Vdc, 0-10Vdc) or Eight Status Inputs



Four Relay Outputs or Four KYZ Pulse Outputs



10.2: I/O Module Installation

See Section 5.3.8 for wiring instructions for the external I/O Modules, and Section 6.4 for hardware installation instructions.

10.2.1: Power Source for I/O Modules

The Nexus® 1262/1272 does not supply power to the I/O Modules. You must use an external power source, such as the EIG PSIO (12V). Refer to Section 5.3.9 to determine power needed.

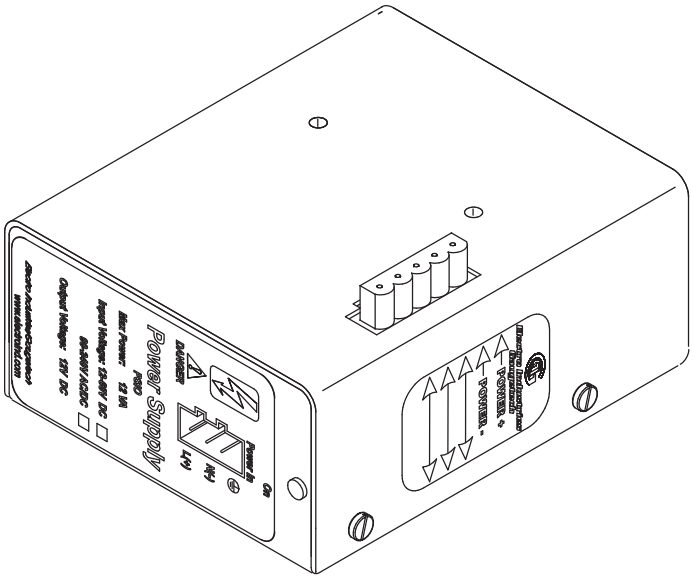


Figure 10.2: PSIO Power Supply Side View, Showing Male RS485 Port

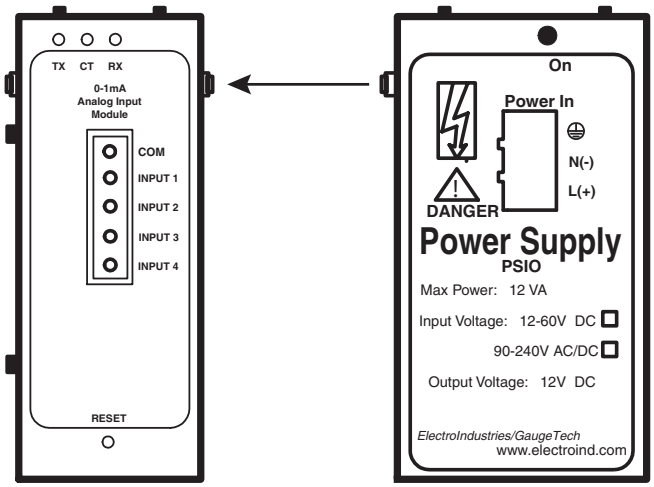


Figure 10.3: Power Flow from PSIO to I/O Module

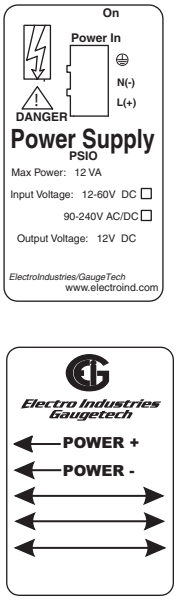


Figure 10.4: PSIO Side and Top Labels (Labels are Red and White)

10.3: Using the PSIO with Multiple I/O Modules

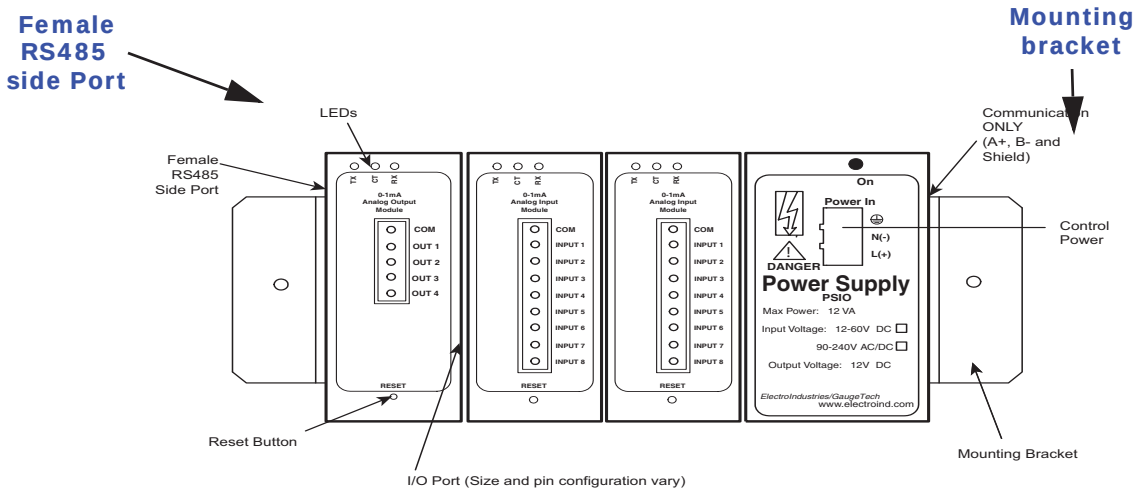


Figure 10.5: PSIO Used with Multiple I/O Modules

NOTE: As shown, the PSIO must be to the right of I/O Modules when viewing the side label.

10.3.1: Steps for Attaching Multiple I/O Modules

1. Each I/O module in a group must be assigned a unique address. See the *Communicator EXT User Manual* for details on configuring and programming the I/O Modules.

2. Determine how many power sources (such as the PSIO) are needed for the number of modules in use. See Sections 5.3.9 for details.

3. Starting with the left module and using a slotted screw driver, fasten the first I/O Module to the left Mounting Bracket. The left Mounting Bracket is the one with the PEM. Fasten the internal screw tightly into the left Mounting Bracket.

4. Next, slide the female RS485 port into the male RS485 side port to connect the next I/O module to the left module. Fasten together enough to grab but do not tighten.

5. One by one combine the modules together.

6. Attach the PSIO (power supply) to the right of the group of I/O Modules it is supplying with power.

NOTE: The PB1 can also be used as a Low Voltage Power Supply. It must be mounted separately.

7. Once you have combined all the I/O modules and power supplies together for the group, fasten tightly. This final tightening will lock the whole group together as a unit.

8. Attach the right Mounting Bracket to the right side of the group using the small Phillips head screws provided.

9. Mount the group of modules on a secure, flat surface. This procedure will insure that all modules stay connected securely.

10.4: Factory Settings and Reset Button

Factory Settings:

All Nexus® I/O Modules are shipped with a preset address and a baud rate of 57600. See following sections for I/O Module addresses.

Reset Button:

If there is a communication problem or if you are unsure of a module's address and baud rate, press and hold the RESET button for 3 seconds; the module will reset to a default address of 247 at 57600 baud rate for 30-seconds. This enables you to interrogate the I/O using the Communicator EXT software; see the *Modbus Communicating I/O Modules User Manual*.

10.5: Analog Transducer Signal Output Modules

Analog Transducer Signal Output Module Specifications	
Model Numbers	1mAON4: 4-channel analog output 0±1mA
	1mAON8: 8-channel analog output 0±1mA
	20mAON4: 4-channel analog output 4-20mA
	20mAON8: 8-channel analog output 4-20mA
Accuracy	0.1% of Full Scale
Scaling	Programmable
Communication	RS485, Modbus RTU
	Programmable Baud Rates: 4800, 9600, 19200, 38400, 57600
Power Requirement	15-20VDC @50-200mA
Operating Temperature	(-20 to +70)^{o} C/(-4 to +158)^{o} F
Maximum Load Impedance	0±1mA: 10k Ohms; 4-20mA: 500 Ohms
Factory Settings	Modbus Address: 1mAON4: 128; 1mAON8: 128; 20mAON4: 132; 20mAON8: 132
	Baud Rate: 57600
	Transmit Delay Time: 0
Default Settings (Reset Button)	Modbus Address: 247
	Baud Rate: 57600
	Transmit Delay Time: 20msec

10.5.1: Overview

The Analog Transducer Signal Output Modules (0±1mA or 4–20mA) are available in either a 4- or 8-channel configuration. Maximum registers per request, read or write, is 17 registers.

All outputs share a single common point. This is also an isolated connection (from ground).

The Modbus Map for the Analog Output Module (and operating details) can be found in the *Modbus Communicating I/O Modules* Manual.

10.5.2: Normal Mode

Normal Mode is the same for the 0-1mA and the 4-20mA Analog Output Modules except for the number of processes performed by the modules.

Both devices:

1. Accept new values through communication.

2. Output current loops scaled from previously accepted values.

The 0-1mA module includes one more process in its Normal Mode:

3. Read and average the A/D and adjust values for Process 2 above.

The device will operate with the following default parameters:

Address: 247 (F7H)

Baud Rate: 57600 Baud

Transmit Delay Time: 20 msec

Normal Operation is prevented by a number of occurrences. See Section 10.4 for details.

10.6: Analog Input Modules

Analog Input Module Specifications	
Model Numbers	8AI1: 8-channel analog input 0±1mA
	8AI2: 8-channel analog input 0±20mA
	8AI3: 8-channel analog input 0±5VDC
	8AI4: 8-channel analog input 0±10VDC
Accuracy	0.25% of Full Scale
Scaling	Programmable
Communication	RS485, Modbus RTU
	Programmable Baud Rates: 4800, 9600, 19200, 38400, 57600
Power Requirement	15-20VDC @50-200mA
Operating Temperature	(-20 to +70)^{o} C/(-4 to +158)^{o} F
Maximum Load Impedance	0±1mA: 10k Ohms; 4-20mA: 500 Ohms
Factory Settings	Modbus Address: 8AI1: 136; 8AI2: 140; 8AI3: 144; 8AI4: 148
	Baud Rate: 57600
	Transmit Delay Time: 0
Default Settings (Reset Button)	Modbus Address: 247
	Baud Rate: 57600
	Transmit Delay Time: 20msec

10.6.1: Overview

The Analog Input Modules (0±1mA, 0±20mA, 0±5Vdc and 0±10Vdc) are available in 8-channel format. Maximum registers per request, read or write, is 17 registers.

All inputs share a single common point. This is also an isolated connection (from ground).

The Modbus Map for the Analog Output Module (and operating details) can be found in the *Modbus Communicating I/O Modules* Manual.

10.6.2: Normal Mode

In Normal Mode, the Input Module:

1. Reads and averages the A/D and adjusts values for process 2.

2. Calculates the percentage of Input Value.

NOTE: The percentage value of the Input is stored in Input Value Registers (Registers 04097-04104).

The device will operate with the following default parameters:

Address: 247 (F7H)

Baud Rate: 57600 Baud

Transmit Delay Time: 20 msec

Normal Operation is prevented by a number of occurrences. See Section 10.4 for details.

10.7: Digital Dry Contact Relay Output (Form C) Module

Digital Dry Contact Relay Output Module Specifications	
Model Number	4RO1: 4 matching relay outputs
Contact Type	Changeover (SPDT)
Relay Type	Mechanically latching
Communication	RS485, Modbus RTU
	Programmable Baud Rates: 4800, 9600, 19200, 38400, 57600
Power Requirement	2.0W max @ 12-20VDC
Operating Temperature	(-20 to +70)^{o} C/(-4 to +158)^{o} F
Switching Voltage	AC 250V / DC 30V
Switching Power	1250VA / 150W
Switching Current	5A
Mechanical Life	5 x 10^{7} switching operations
Electrical Life	10^{5} switching operations at rated current
Factory Settings	Modbus Address: 156
	Baud Rate: 57600
	Transmit Delay Time: 0
Default Settings (Reset Button)	Modbus Address: 247
	Baud Rate: 57600
	Transmit Delay Time: 20msec

10.7.1: Overview

The Relay Output Module consists of four Latching Relay Outputs. In Normal Mode, the device accepts commands to control the relays. Relay output modules are triggered by limits programmed with the Communicator EXT software. See the *Communicator EXT User Manual* for details on programming limits.

The Modbus Map for the Analog Output Module (and operating details) can be found in the *Modbus Communicating I/O Modules* Manual.

Each latching relay will hold its state in the event of a power loss.

10.7.2: Communication

Maximum registers per request, read or write, is 4 registers.

The device will operate with the following default parameters:

Address: 247 (F7H)

Baud Rate: 57600 Baud

Transmit Delay Time: 20 msec

Some situations will cause the device to operate with the above Default Parameters. See Section 10.4 for details of Default Mode.

10.7.3: Normal Mode

Normal Mode consists of one process: the device accepts new commands to control the relays.

10.8: Digital Solid State Pulse Output (KYZ) Module

Digital Solid State Pulse Output Module Specifications	
Model Number	4PO1
Communication	RS485, Modbus RTU
	Programmable Baud Rates: 4800, 9600, 19200, 38400, 57600
Power Requirement	15-20VDC @50-200mA
Operating Temperature	(-20 to +70)^{o} C/(-4 to +158)^{o} F
Voltage Rating	Up to 300VDC
Commands Accepted	Read and Write with at least 4 registers of data per command
Memory	256 Byte IC EEPROM for storage of programmable settings and non-volatile memory
Factory Settings	Modbus Address: 160
	Baud Rate: 57600
	Transmit Delay Time: 0
Default Settings (Reset Button)	Modbus Address: 247
	Baud Rate: 57600
	Transmit Delay Time: 20msec

10.8.1: Overview

The KYZ Pulse Output Modules have 4 KYZ Pulse Outputs and accept Read and Write Commands with at least 4 registers of data per command. Digital Solid State Pulse Output (KYZ) Modules are user programmed to reflect VAR-hours, WATT-hours, or VA-hours. See the *Modbus Communicating I/O Modules User Manual* for details on programming the module.

The Modbus Map for the KYZ Pulse Output Module (and operating details) can be found in the *Modbus Communicating I/O Modules Manual*.

NC = Normally Closed; NO = Normally Open; C = Common.

10.8.2: Communication

Maximum registers per request, read or write, is 4 registers.

The device will operate with the following Default Mode Parameters. See Section 10.4 for details.

Address: 247 (F7H)

Baud Rate: 57600 Baud

Transmit Delay Time: 20 msec

10.8.3: Normal Mode

Energy readings are given to the device frequently. The device generates a pulse at each channel after a certain energy increase.

Normal Operation consists of three processes:

1. The first process accepts writes to registers 04097 - 04112. Writes can be up to four registers long and should end on the fourth register of a group (register 04100, or registers 04103-04112 or registers 04109-04112). These writes can be interpreted as two-byte, four-byte, six-byte or eight-byte energy readings. The reception of the first value for a given channel provides the initial value for that channel. Subsequent writes will increment the Residual for that channel by the difference of the old value and the new value. The previous value is then replaced with the new value. Attempting to write a value greater than the programmed Rollover Value for a given channel is completely ignored and no registers are modified. If the difference is greater than half of the programmed Rollover Value for a given channel, the write does not increment the Residual but does update the Last Value. Overflow of the Residual is not prevented.

2. The second process occurs in the main loop and attempts to decrement the Residual by the Programmed Energy/Pulse Value. If the Residual is greater than the Programmed Energy/Pulse Value and the Pending Pulses Value for that channel has not reached the maximum limit, then Residual is decremented appropriately and the Pending Pulses is increased by two, signifying two more transitions and one more pulse.

3. The third process runs from a timer which counts off pulse widths from the Programmable Minimum Pulse Width Values. If there are Pulses Pending for a channel and the delay has passed, then the Pulses Pending is decremented for that channel and the Output Relay is toggled.

Operation Indicator (0000H = OK, 1000H = Problem):

Bit 1:1 = EEPROM Failure

Bit 2:1 = Checksum for Communications Settings bad

Bit 3:1 = Checksum for Programmable Settings bad

Bit 4:1 = 1 or mor Communications Settings are invalid

Bit 5:1 = 1 or more Programmable Settings are invalid

Bit 6:1 = 1 or more Programmable Settings have been modified

Bit 7:1 = Forced Default by Reset Value

Bit 15:1 = Normal Operation of the device is disabled

10.9: Digital Status Input Module

Digital Status Input Module Specifications	
Model Number	8DI1
Communication	RS485, Modbus RTU
	Programmable Baud Rates: 4800, 9600, 19200, 38400, 57600
Power Requirement	15-20VDC @50-200mA
Operating Temperature	(-20 to +70)^{o} C/(-4 to +158)^{o} F
Voltage Rating	Up to 300VDC
Detection	Wet/Dry, Auto-detect
Memory	256 Byte I^2C EEPROM for storage of programmable settings and non-volatile memory
Factory Settings	Modbus Address: 164
	Baud Rate: 57600
	Transmit Delay Time: 0
Default Settings (Reset Button)	Modbus Address: 247
	Baud Rate: 57600
	Transmit Delay Time: 20msec

10.9.1: Overview

The Digital Status Input Module is used either for additional status detect or for accumulating pulses from external equipment, such as power meters, water meters, etc.

10.9.2: Communication

Maximum registers per request, read or write, is 4 registers.

The device will operate with the following Default Mode Parameters. See Section 10.4 for details.

Address: 247 (F7H)

Baud Rate: 57600 Baud

Transmit Delay Time: 20 msec

10.9.3: Normal Mode

The device polls the inputs at 100Hz (once every 10 msec), debouncing the inputs and incrementing the Transition Accumulators for each channel as appropriate.

The inputs are represented by Channel 1 in the LSB through Channel 8 in the MSB of the low order byte of the register.

The Modbus Map for the Digital Status Input Modules (and operating details) can be found in the *Modbus Communicating I/O Modules Manual*.

This page intentionally left blank.

11: Electrical Installation

The Nexus® 1262/1272 Socket meter supported forms and their wiring configurations are shown in this chapter. The forms are based on the rated Voltage and hookup required for your application. (Custom forms and configurations are also available from EIG.)

11.1: Considerations When Installing Meters

Installation of the Nexus® 1262/1272 meter must be performed only by qualified personnel who follow standard safety precautions during all procedures. Those personnel should have appropriate training and experience with high voltage devices. Appropriate safety gloves, safety glasses and protective clothing are recommended.

During normal operation of the Nexus® meter, dangerous voltages flow through many parts of the unit, including: Terminals and any connected CTs (Current Transformers) and PTs (Potential Transformers), all I/O Modules and their circuits. **All Primary and Secondary circuits can, at times, produce lethal voltages and currents. Avoid contact with any current-carrying surfaces**.

Do not use the meter or any I/O device for primary protection or in an energy-limiting capacity. The meter can only be used as secondary protection.

Do not use the meter for applications where failure of the meter may cause harm or death.

Do not use the meter for any application where there may be a risk of fire.

All meter terminals should be inaccessible after installation.

Do not apply more than the maximum voltage the meter or any attached device can withstand. Refer to meter and/or device labels and to the Specifications for all devices before applying voltages. Do not HIPOT/Dielectric test any Outputs, Inputs or Communications terminals.

The current inputs are only to be connected to external current transformers.

EIG recommends the use of Fuses for voltage leads and power supply, and shorting blocks to prevent hazardous voltage conditions or damage to CTs, if the meter needs to be removed from service. **CT grounding is optional**.

NOTE: IF THE EQUIPMENT IS USED IN A MANNER NOT SPECIFIED BY THE MANUFACTURER, THE PROTECTION PROVIDED BY THE EQUIPMENT MAY BE IMPAIRED.

NOTE: THERE IS NO REQUIRED PREVENTIVE MAINTENANCE OR INSPECTION NECESSARY FOR SAFETY. HOWEVER, ANY REPAIR OR MAINTENANCE SHOULD BE PERFORMED BY THE FACTORY.

DISCONNECT DEVICE: The following part is considered the equipment disconnect device.

A SWITCH OR CIRCUIT-BREAKER SHALL BE INCLUDED IN THE END-USE EQUIPMENT OR BUILDING INSTALLATION. THE SWITCH SHALL BE IN CLOSE PROXIMITY TO THE EQUIPMENT AND WITHIN EASY REACH OF THE OPERATOR. THE SWITCH SHALL BE MARKED AS THE DISCONNECTING DEVICE FOR THE EQUIPMENT.

11.2: Blade Configuration for Forms 9S, 36S, and 45S

Detailed drawings of the Blade configurations are shown below and on the next page. There are two configurations because the 9S and the 36S are the same.

NOTE: The forms referred to in this chapter comply with ANSI forms 9S, 36S and 45S.

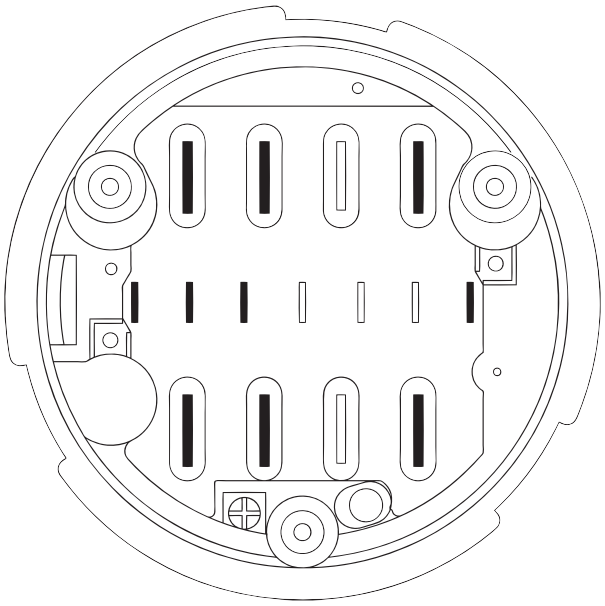


Figure 11.1: Form 9S & 36S Base with Knock Out Holes

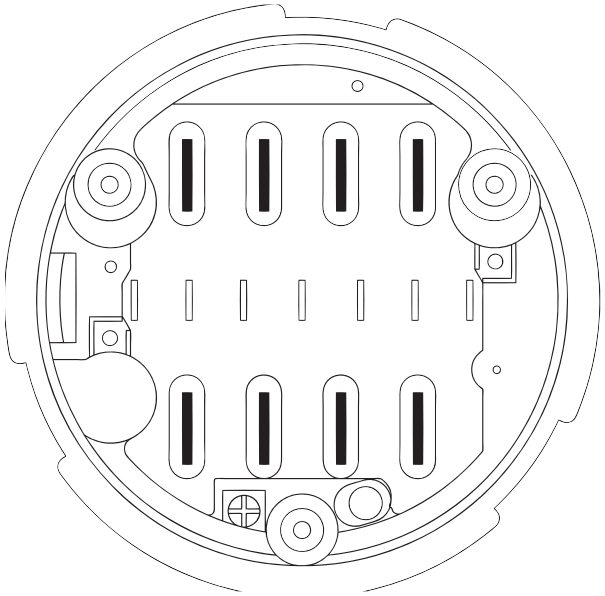


Figure 11.2: Form 45S Base with Knock Out Holes

11.3: Wiring Diagrams

Choose from the supported meter forms based on the rated Voltage and hookup required for your application. Corresponding wiring diagrams appear on the following pages. If the connection diagram you need is not listed, contact EIG for a custom connection diagram. Form 9S mounted in an A/S Adapter is shown in Figure 11.19.

NOTE: Form 45S replaces Form 5S and may also be used in 4-wire circuits.

Form	Description	Figure#
9S	Wye, no PTs, 3 CTs	11.3
	Wye, 3 PTs, 3 CTs	11.4
	4-Wire Delta, no PTs, 3 CTs	11.5
	4-Wire Delta, 3 PTs, 3 CTs	11.6
	4-Wire Delta, no PTs, 2 CTs	11.7
	4-Wire Delta, 2 PTs, 2 CTs	11.8
	3-Wire Delta, no PTs, 2 CTs	11.9
	3-Wire Delta, 2 PTs, 2 CTs	11.10
36S	2.5 EL Wye, no PTs, 3 CTs	11.11
	2.5 EL Wye, 2 PTs, 3 CTs	11.12
45S	Wye, no PTs, 3 CTs	11.13
	Wye, 2 PTs, 3 CTs	11.14
	3-wire Delta, no PTs, 2 CTs	11.15
	3-wire Delta, 2 PTs, 2 CTs	11.16
	4-wire Delta, no PTs, 2 CTs	11.17
	4-wire Delta, 2 PTs, 2 CTs	11.18
9S in S/A	Form 9S Mounted in S/A Adapter (showing connectors)	11.19

Table 11.1: Nexus® 1262/1272 Meter Forms

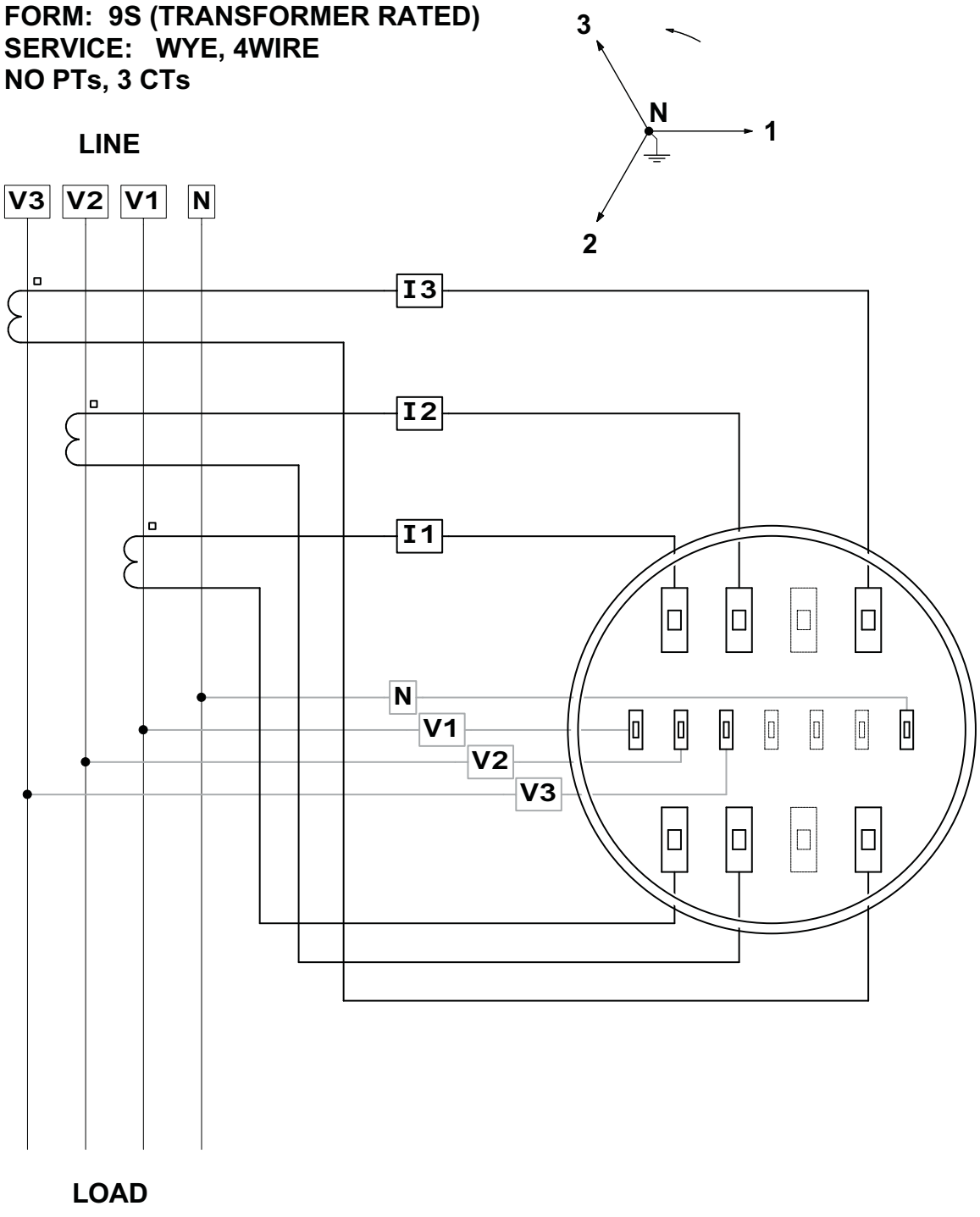


Figure 11.3: Form 9S Wye, no PTs, 3 CTs

- The protective ground connections for the transformers are omitted in the diagrams and are not required for the meter to work properly. However, we strongly recommend those connections to reduce shock hazard.
- Shorting switches (blocks) for the current transformers' secondary side are also not shown. To prevent electrical shock we recommended you use such shorting switches (blocks). Make sure the CTs' secondary are shorted before disconnecting them from the meter's current input terminals.

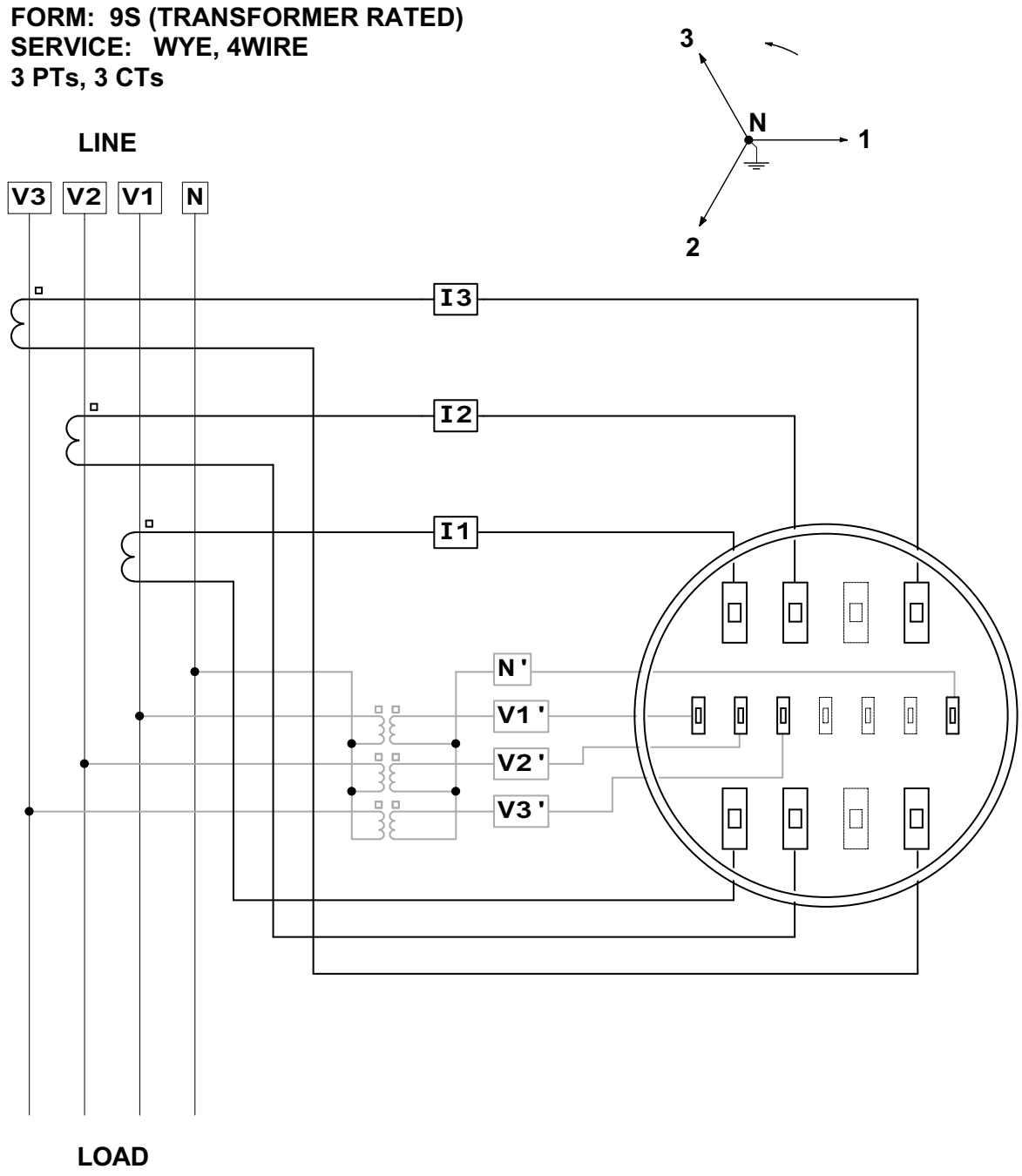


Figure 11.4: Form 9S Wye, 3 PTs, 3 CTs

- The protective ground connections for the transformers are omitted in the diagrams and are not required for the meter to work properly. However, we strongly recommend those connections to reduce shock hazard.
- Shorting switches (blocks) for the current transformers' secondary side are also not shown. To prevent electrical shock we recommended you use such shorting switches (blocks). Make sure the CTs' secondary are shorted before disconnecting them from the meter's current input terminals.

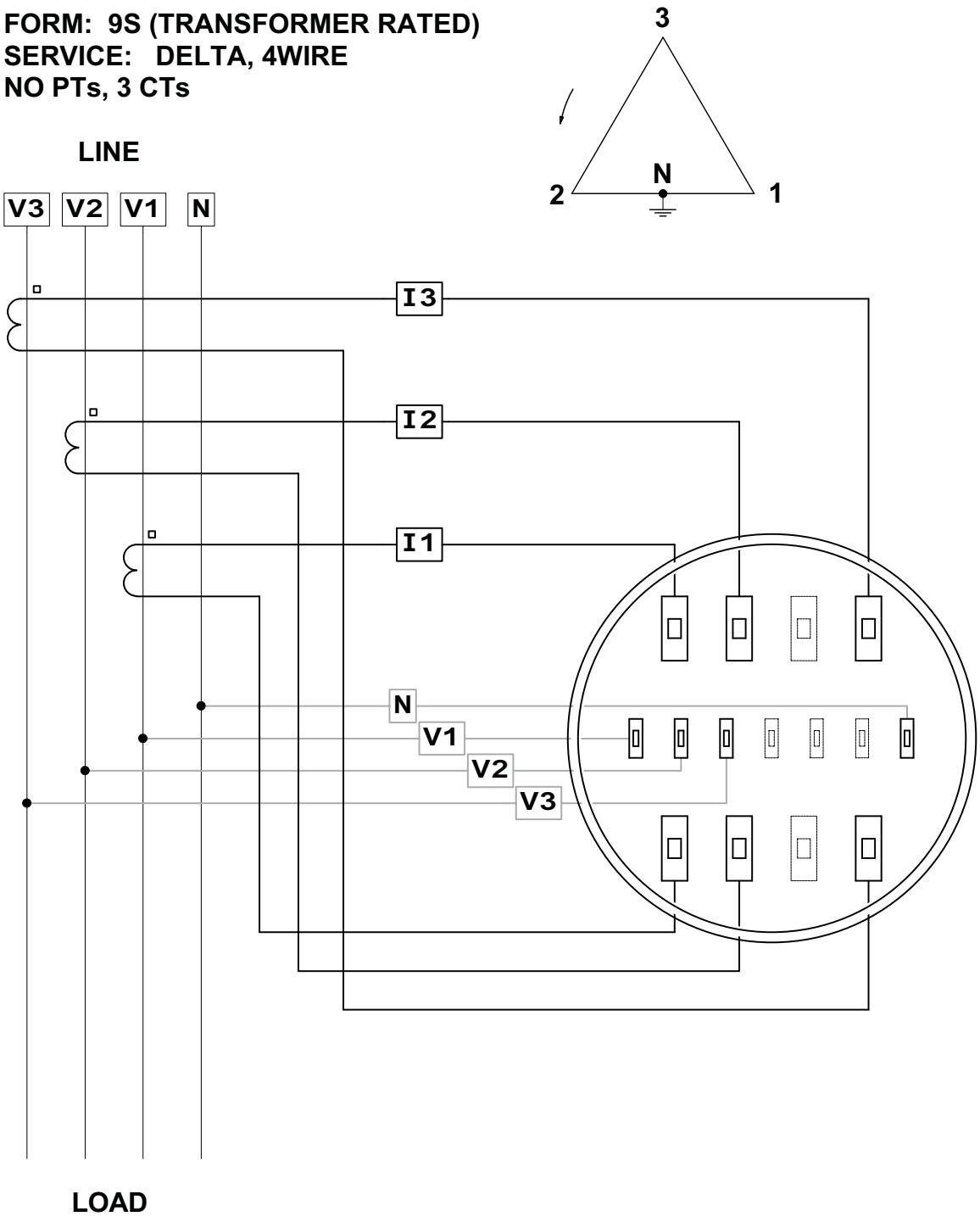


Figure 11.5: Form 9S 4-Wire Delta, no PTs, 3 CTs

- The protective ground connections for the transformers are omitted in the diagrams and are not required for the meter to work properly. However, we strongly recommend those connections to reduce shock hazard.
- Shorting switches (blocks) for the current transformers' secondary side are also not shown. To prevent electrical shock we recommended you use such shorting switches (blocks). Make sure the CTs' secondary are shorted before disconnecting them from the meter's current input terminals.

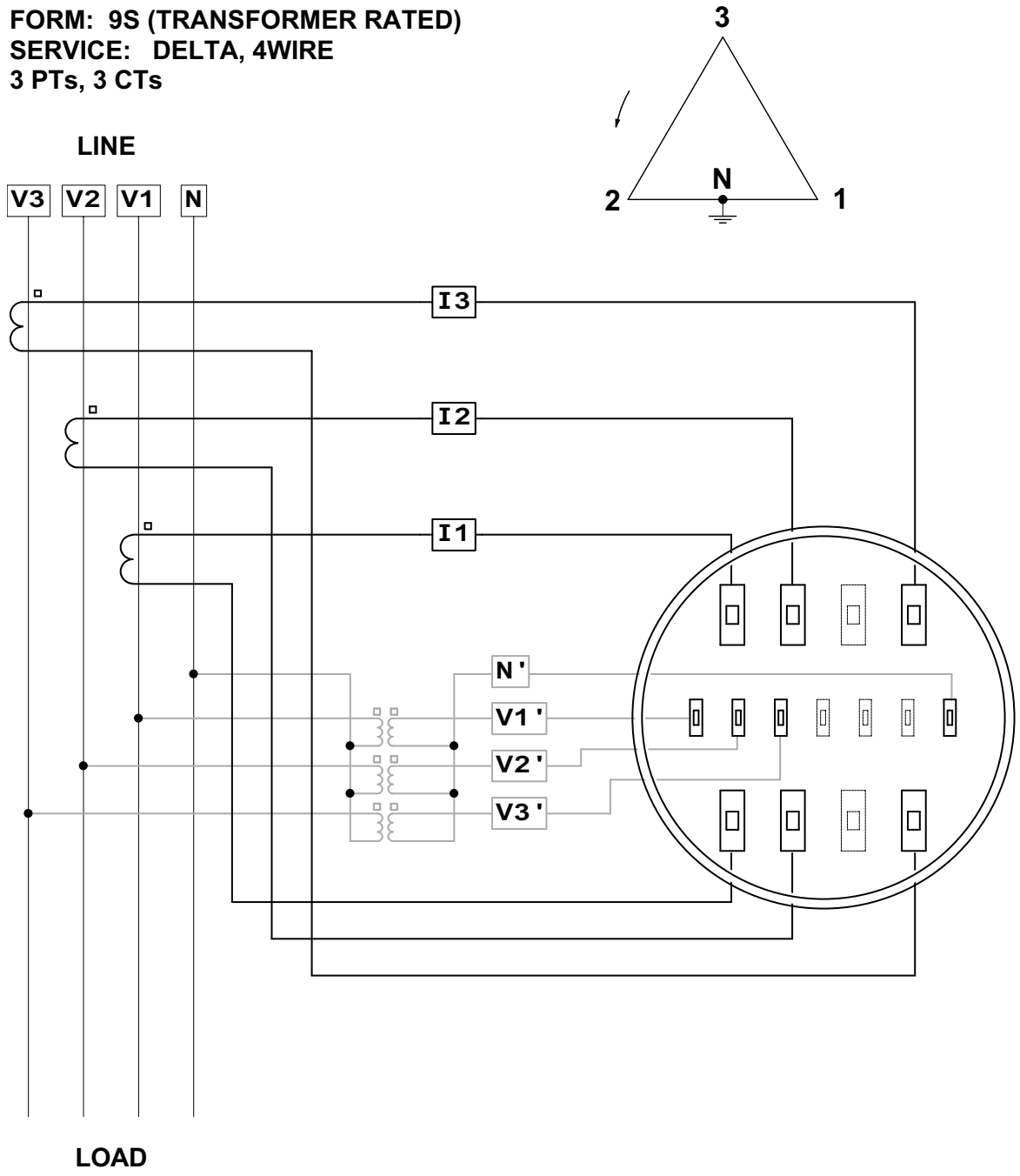


Figure 11.6: Form 9S 4-Wire Delta, 3 PTs, 3 CTs

- The protective ground connections for the transformers are omitted in the diagrams and are not required for the meter to work properly. However, we strongly recommend those connections to reduce shock hazard.
- Shorting switches (blocks) for the current transformers' secondary side are also not shown. To prevent electrical shock we recommended you use such shorting switches (blocks). Make sure the CTs' secondary are shorted before disconnecting them from the meter's current input terminals.

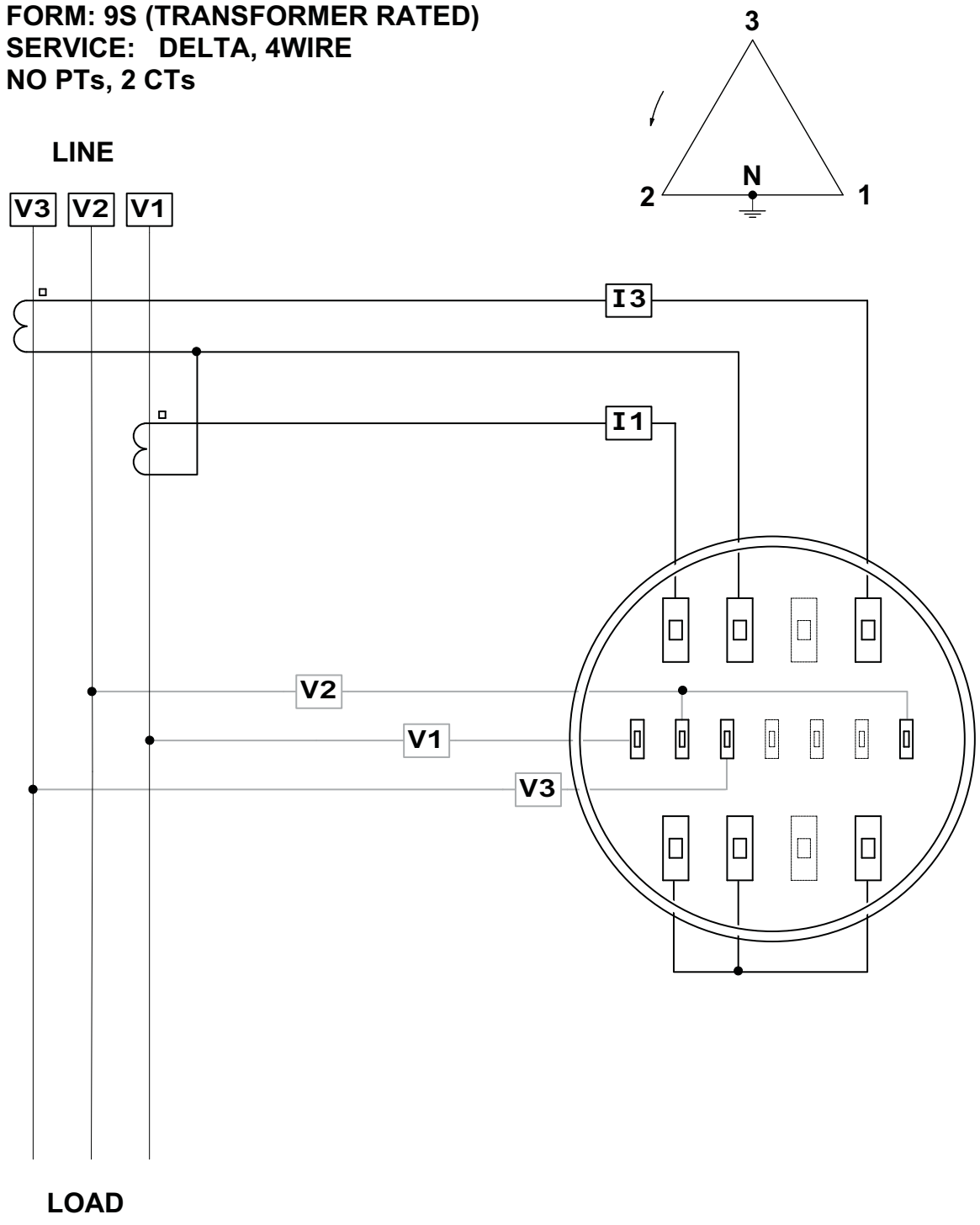


Figure 11.7: Form 9S 4-Wire Delta no PTs, 2 CTs

- The protective ground connections for the transformers are omitted in the diagrams and are not required for the meter to work properly. However, we strongly recommend those connections to reduce shock hazard.
- Shorting switches (blocks) for the current transformers' secondary side are also not shown. To prevent electrical shock we recommended you use such shorting switches (blocks). Make sure the CTs' secondary are shorted before disconnecting them from the meter's current input terminals.

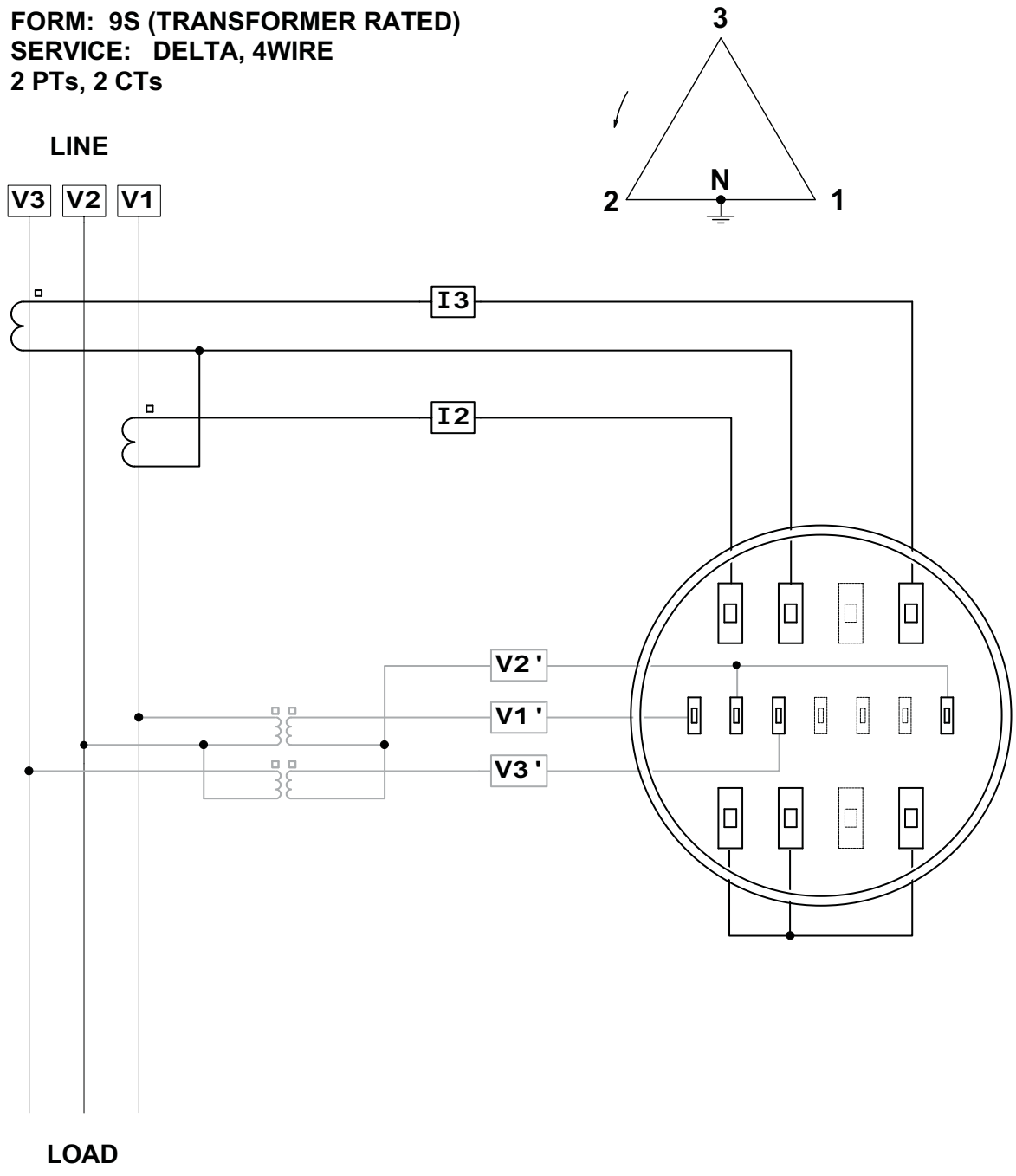


Figure 11.8: Form 9S 4-Wire Delta, 2 PTs, 2 CTs

- The protective ground connections for the transformers are omitted in the diagrams and are not required for the meter to work properly. However, we strongly recommend those connections to reduce shock hazard.
- Shorting switches (blocks) for the current transformers' secondary side are also not shown. To prevent electrical shock we recommended you use such shorting switches (blocks). Make sure the CTs' secondary are shorted before disconnecting them from the meter's current input terminals.

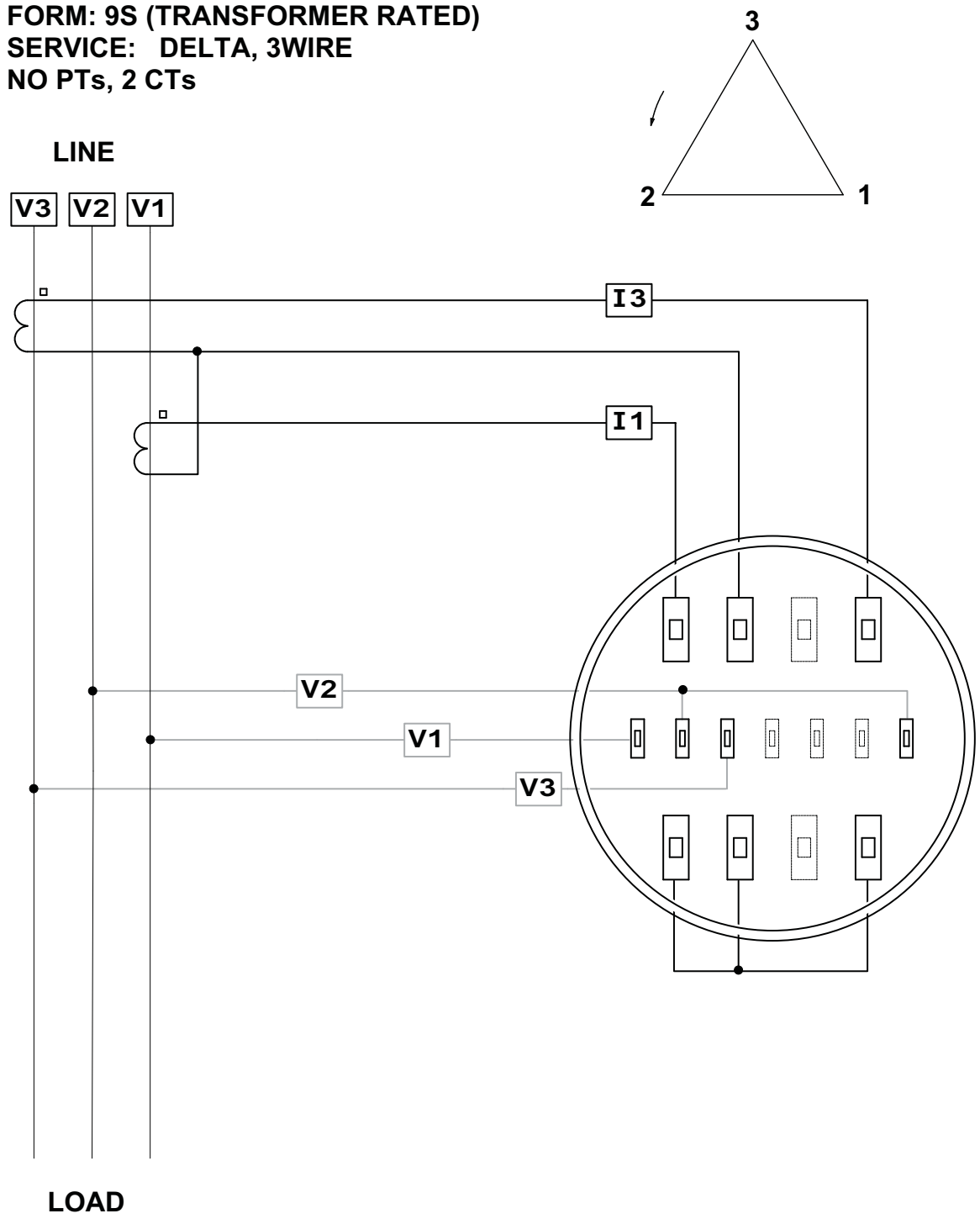


Figure 11.9: Form 9S 3-Wire Delta, no PTs, 2 CTs

- The protective ground connections for the transformers are omitted in the diagrams and are not required for the meter to work properly. However, we strongly recommend those connections to reduce shock hazard.
- Shorting switches (blocks) for the current transformers' secondary side are also not shown. To prevent electrical shock we recommended you use such shorting switches (blocks). Make sure the CTs' secondary are shorted before disconnecting them from the meter's current input terminals.

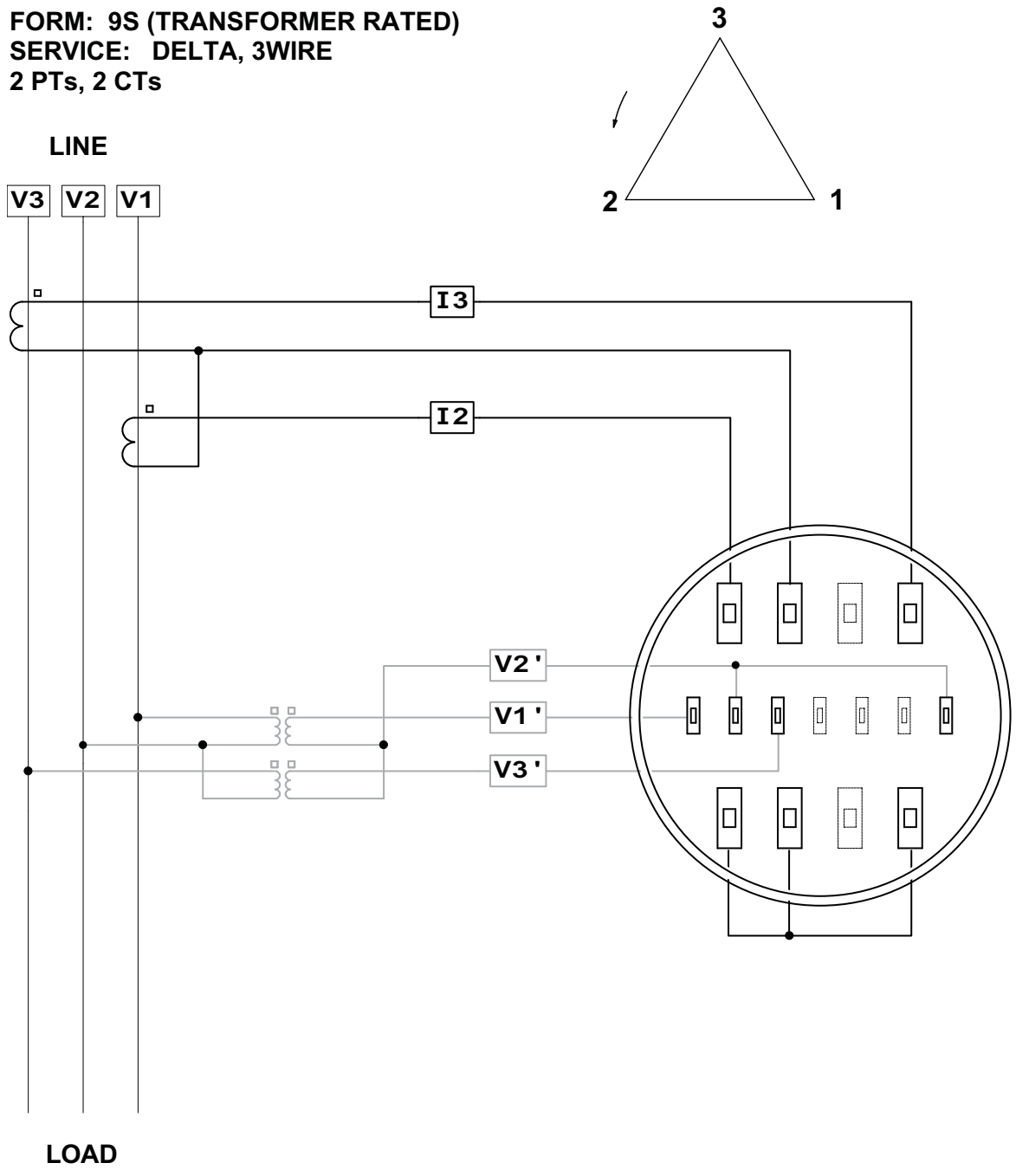


Figure 11.10: Form 9S 3-Wire Delta, 2 PTs, 2 CTs

- The protective ground connections for the transformers are omitted in the diagrams and are not required for the meter to work properly. However, we strongly recommend those connections to reduce shock hazard.
- Shorting switches (blocks) for the current transformers' secondary side are also not shown. To prevent electrical shock we recommended you use such shorting switches (blocks). Make sure the CTs' secondary are shorted before disconnecting them from the meter's current input terminals.

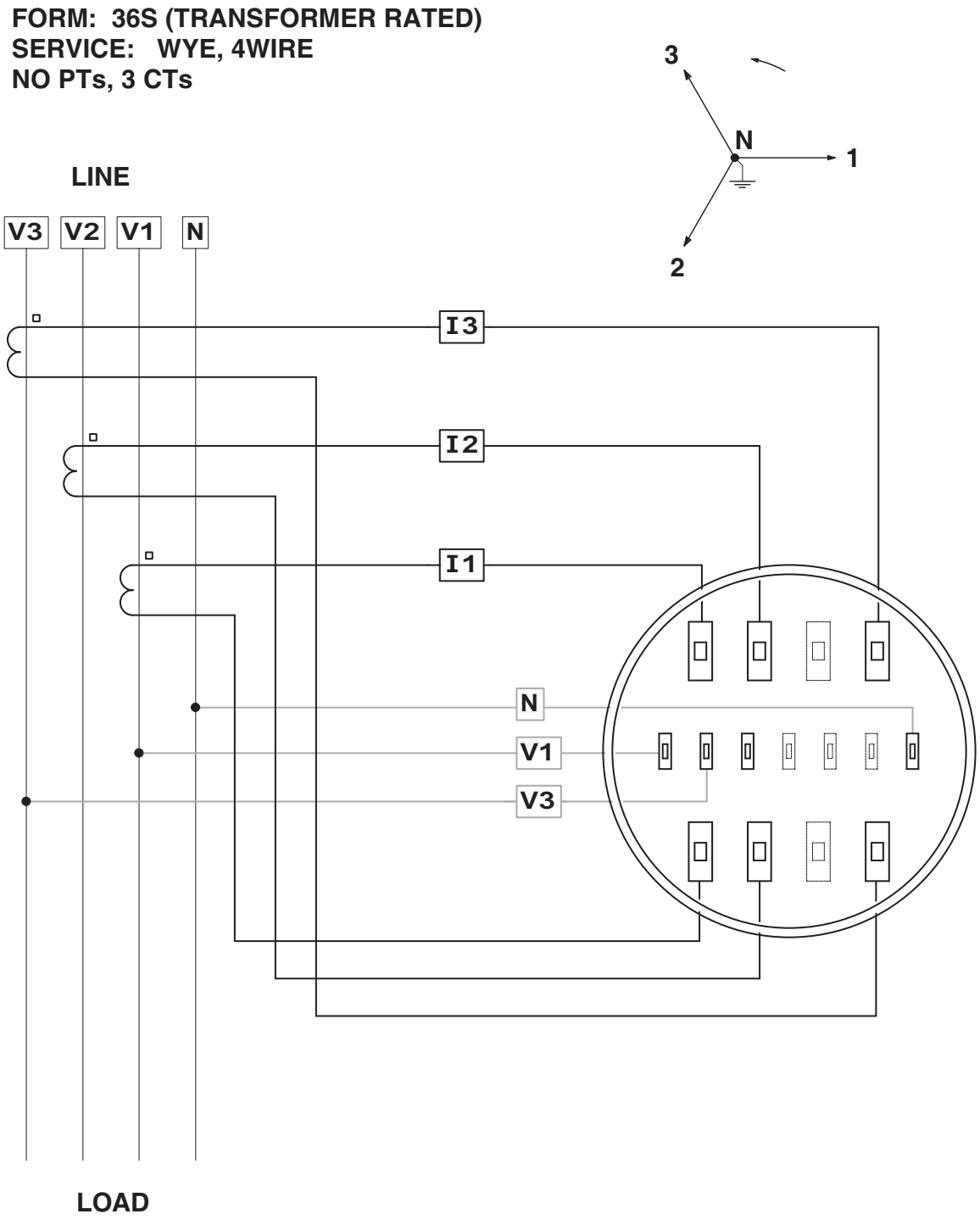


Figure 11.11: Form 36S 2.5 Element Wye, no PTs, 3 CTs

- The protective ground connections for the transformers are omitted in the diagrams and are not required for the meter to work properly. However, we strongly recommend those connections to reduce shock hazard.
- Shorting switches (blocks) for the current transformers' secondary side are also not shown. To prevent electrical shock we recommended you use such shorting switches (blocks). Make sure the CTs' secondary are shorted before disconnecting them from the meter's current input terminals.

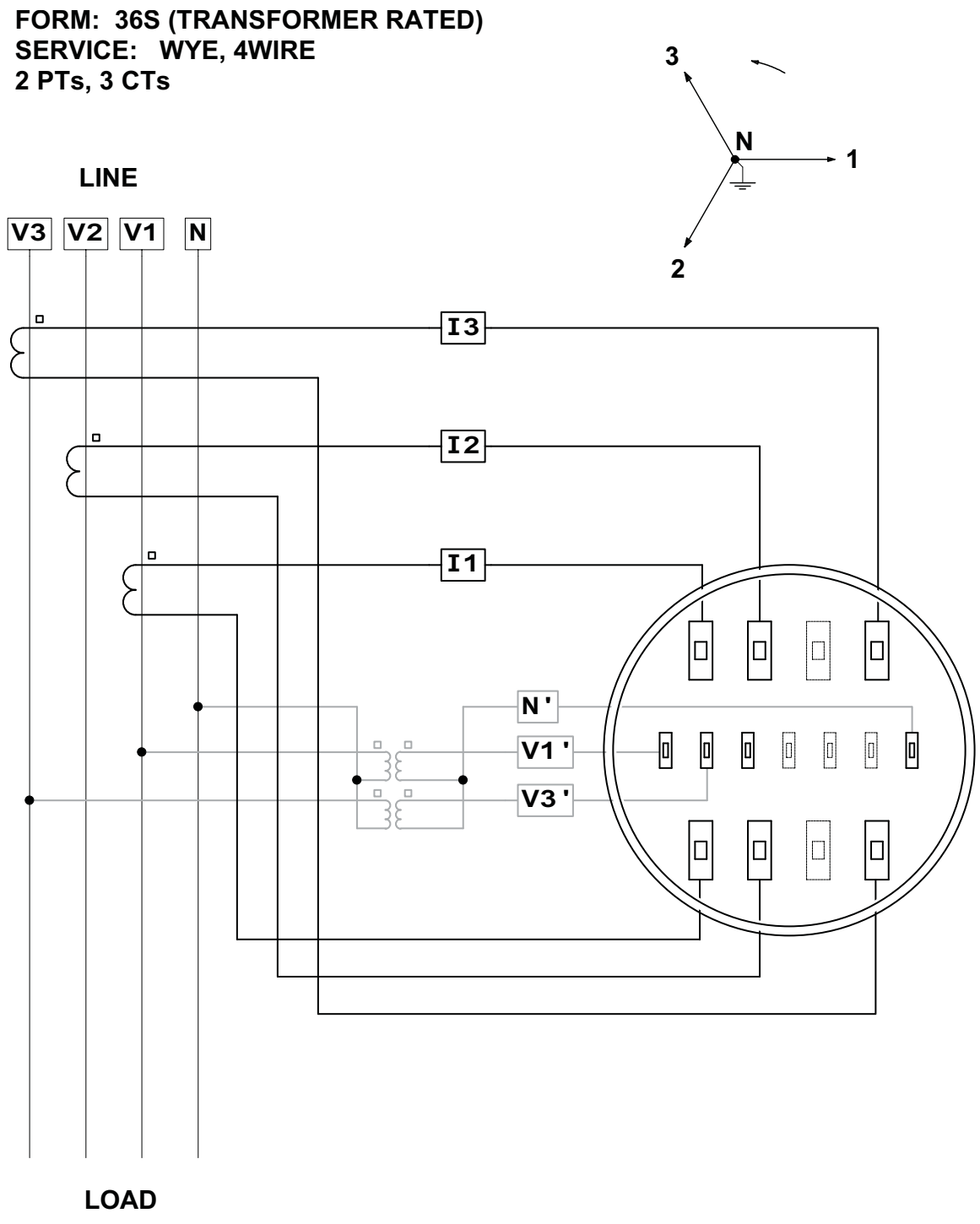


Figure 11.12: Form 36S 2.5 Element Wye, 2 PTs, 3 CTs

- The protective ground connections for the transformers are omitted in the diagrams and are not required for the meter to work properly. However, we strongly recommend those connections to reduce shock hazard.
- Shorting switches (blocks) for the current transformers' secondary side are also not shown. To prevent electrical shock we recommended you use such shorting switches (blocks). Make sure the CTs' secondary are shorted before disconnecting them from the meter's current input terminals.

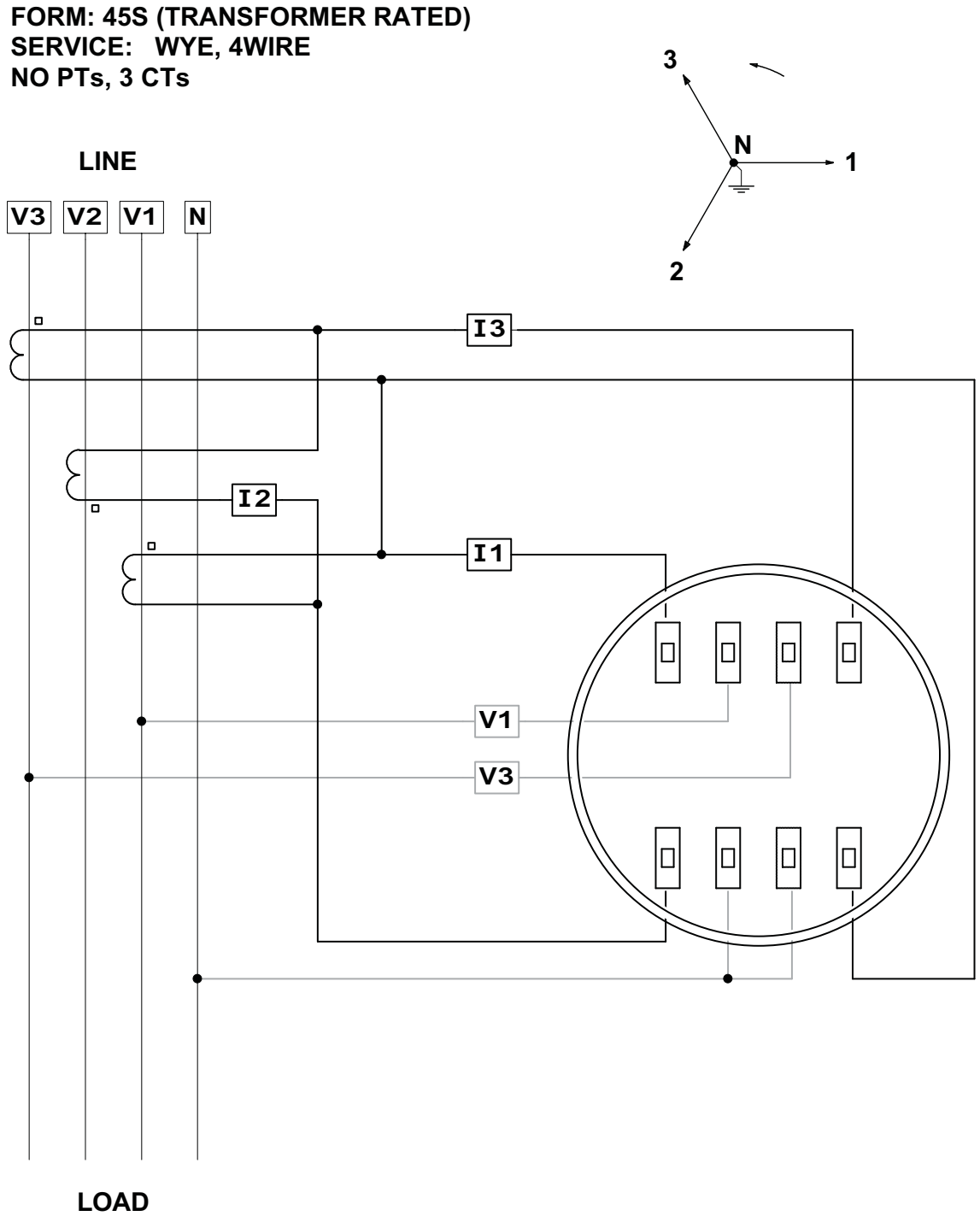


Figure 11.13: Form 45S Wye, no PTs, 3 CTs

- The protective ground connections for the transformers are omitted in the diagrams and are not required for the meter to work properly. However, we strongly recommend those connections to reduce shock hazard.
- Shorting switches (blocks) for the current transformers' secondary side are also not shown. To prevent electrical shock we recommended you use such shorting switches (blocks). Make sure the CTs' secondary are shorted before disconnecting them from the meter's current input terminals.

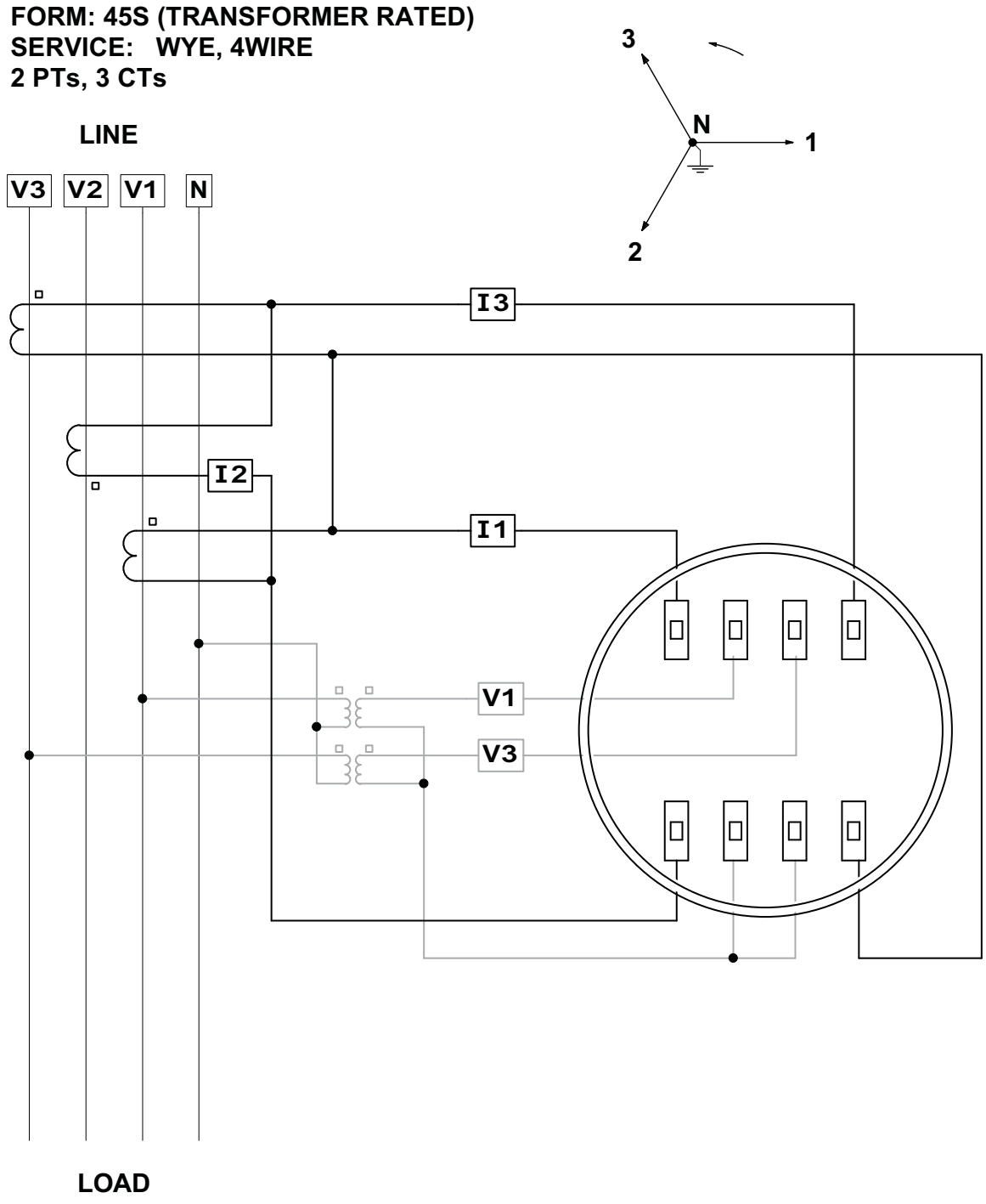


Figure 11.14: Form 45S Wye, 2 PTs, 3 CTs

- The protective ground connections for the transformers are omitted in the diagrams and are not required for the meter to work properly. However, we strongly recommend those connections to reduce shock hazard.
- Shorting switches (blocks) for the current transformers' secondary side are also not shown. To prevent electrical shock we recommended you use such shorting switches (blocks). Make sure the CTs' secondary are shorted before disconnecting them from the meter's current input terminals.

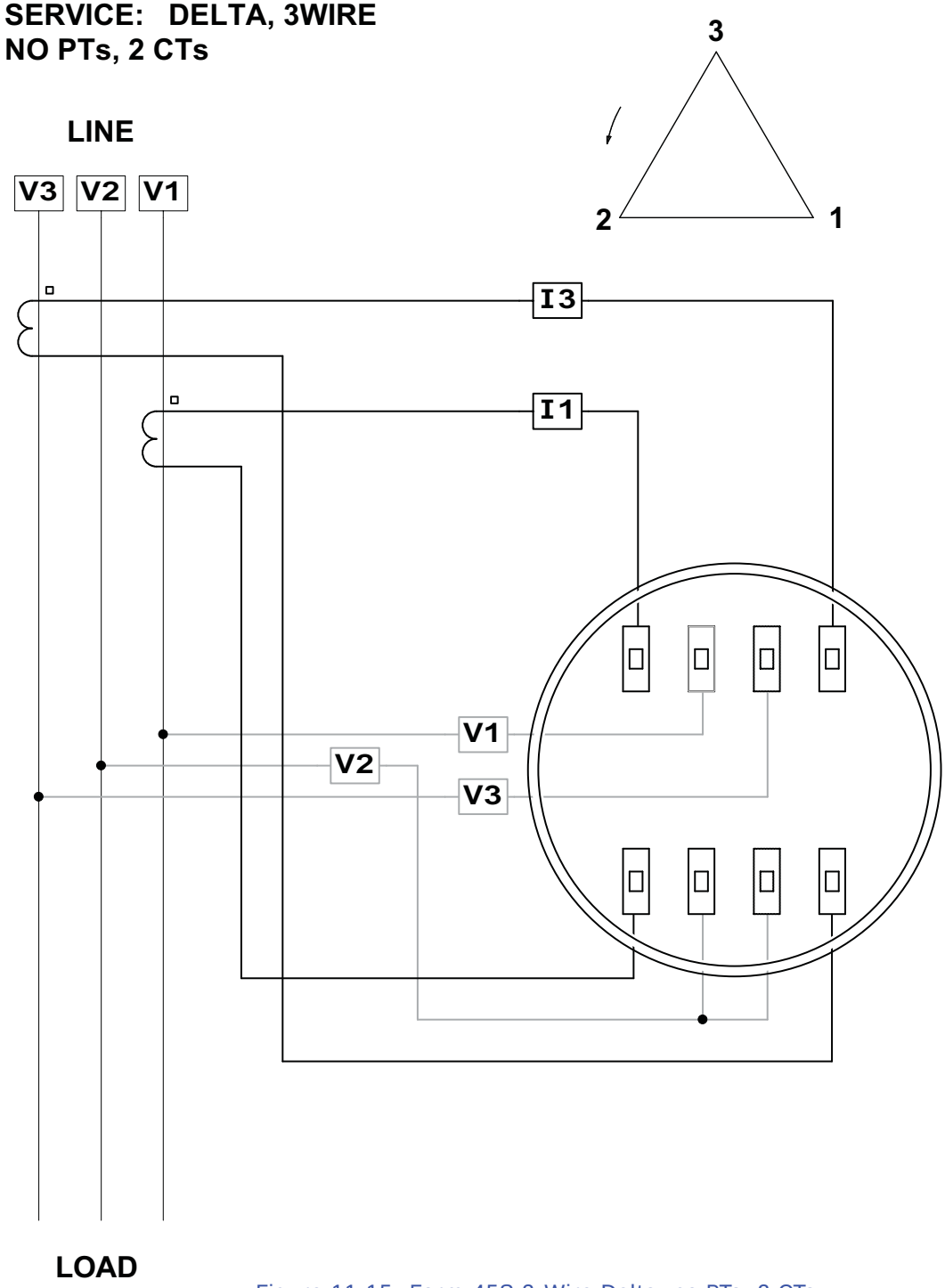


Figure 11.15: Form 45S 3-Wire Delta, no PTs, 2 CTs

- The protective ground connections for the transformers are omitted in the diagrams and are not required for the meter to work properly. However, we strongly recommend those connections to reduce shock hazard.
- Shorting switches (blocks) for the current transformers' secondary side are also not shown. To prevent electrical shock we recommended you use such shorting switches (blocks). Make sure the CTs' secondary are shorted before disconnecting them from the meter's current input terminals.

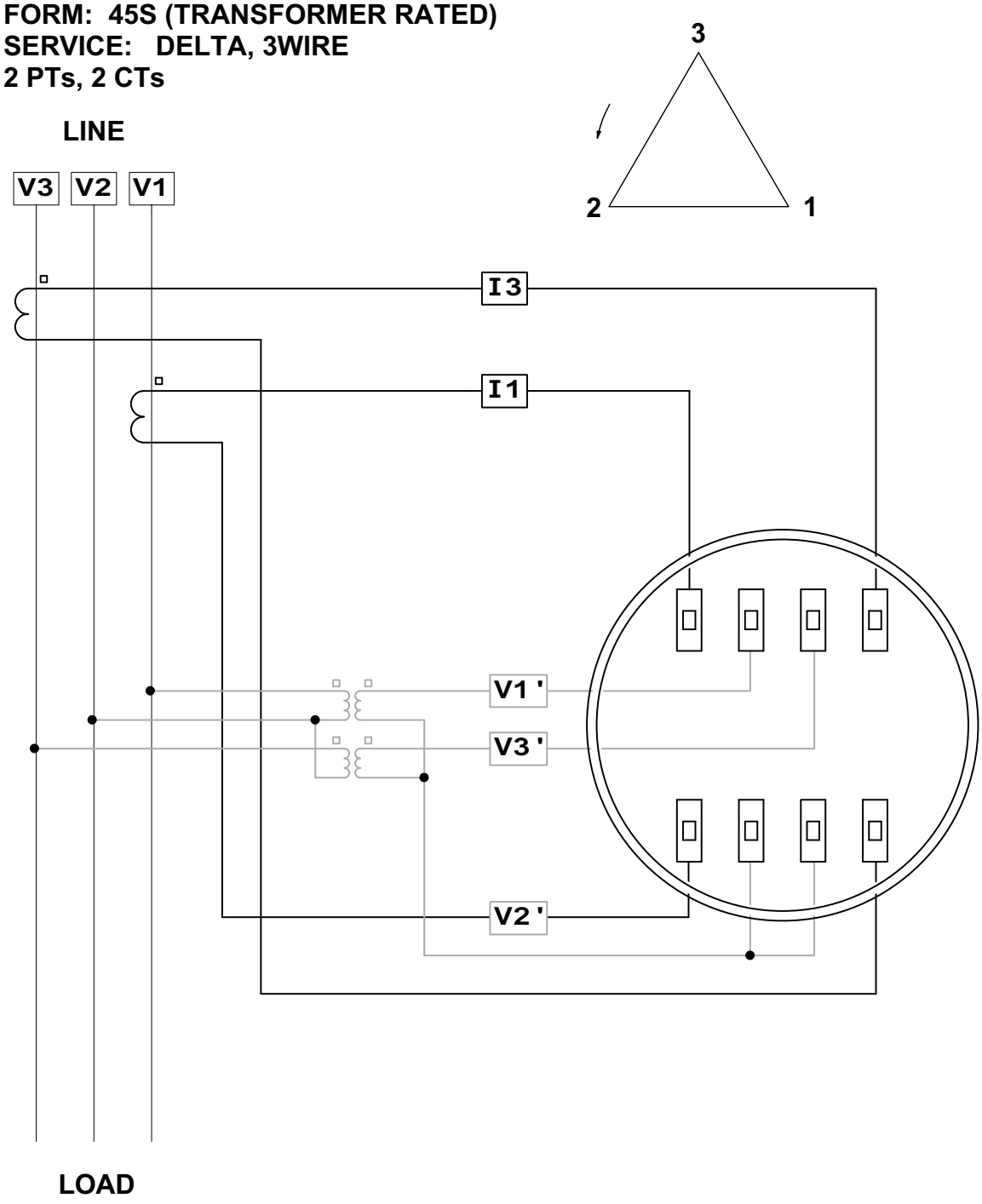


Figure 11.16: Form 45S 3-Wire Delta, 2 PTs, 2 CTs

- The protective ground connections for the transformers are omitted in the diagrams and are not required for the meter to work properly. However, we strongly recommend those connections to reduce shock hazard.
- Shorting switches (blocks) for the current transformers' secondary side are also not shown. To prevent electrical shock we recommended you use such shorting switches (blocks). Make sure the CTs' secondary are shorted before disconnecting them from the meter's current input terminals.

FORM: 45S (TRANSFORMER RATED)
SERVICE: DELTA, 4WIRE
NO PTs, 2 CTs

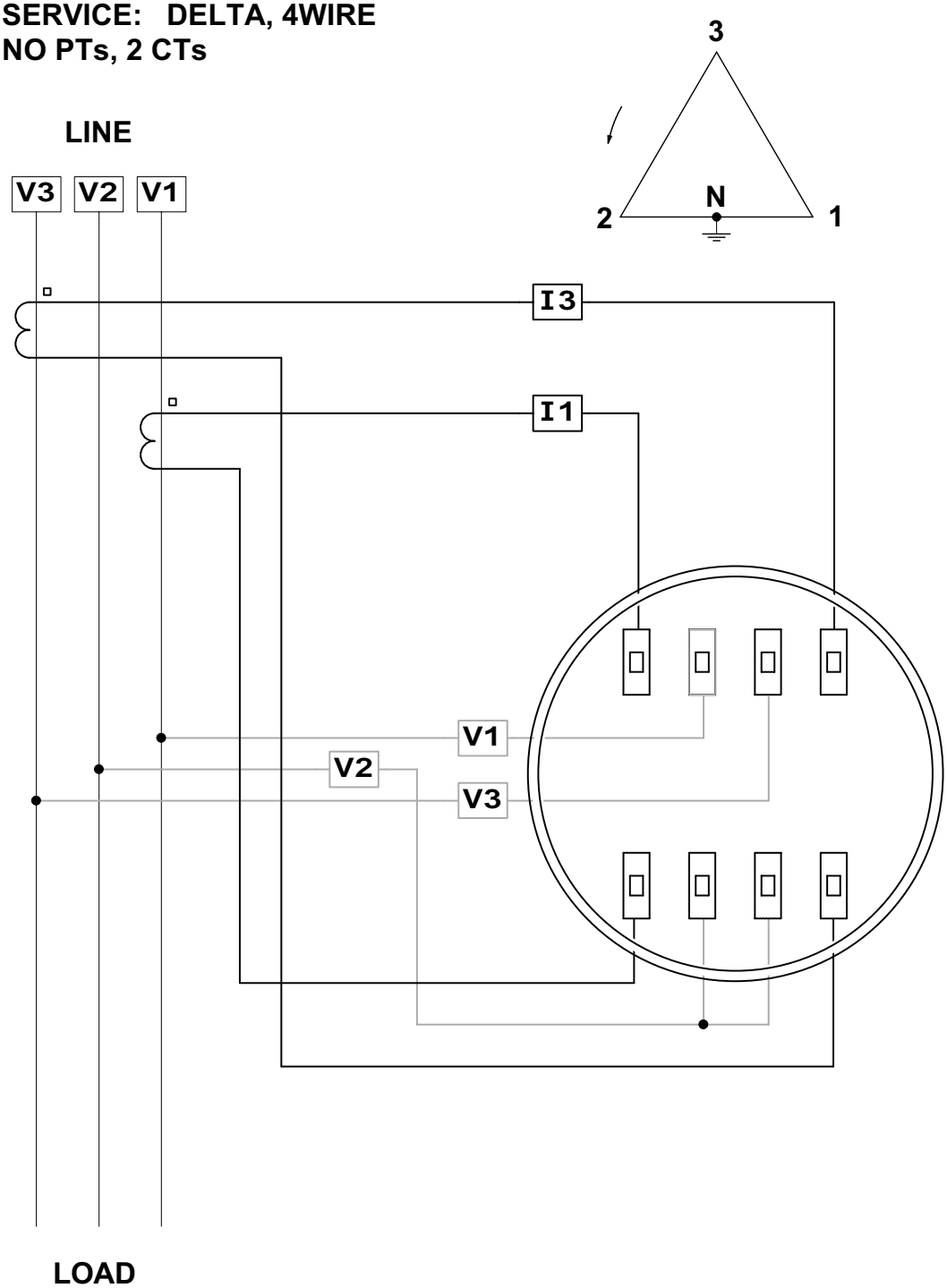


Figure 11.17: Form 45S 4-Wire Delta, no PTs, 2 CTs

- The protective ground connections for the transformers are omitted in the diagrams and are not required for the meter to work properly. However, we strongly recommend those connections to reduce shock hazard.
- Shorting switches (blocks) for the current transformers' secondary side are also not shown. To prevent electrical shock we recommended you use such shorting switches (blocks). Make sure the CTs' secondary are shorted before disconnecting them from the meter's current input terminals.

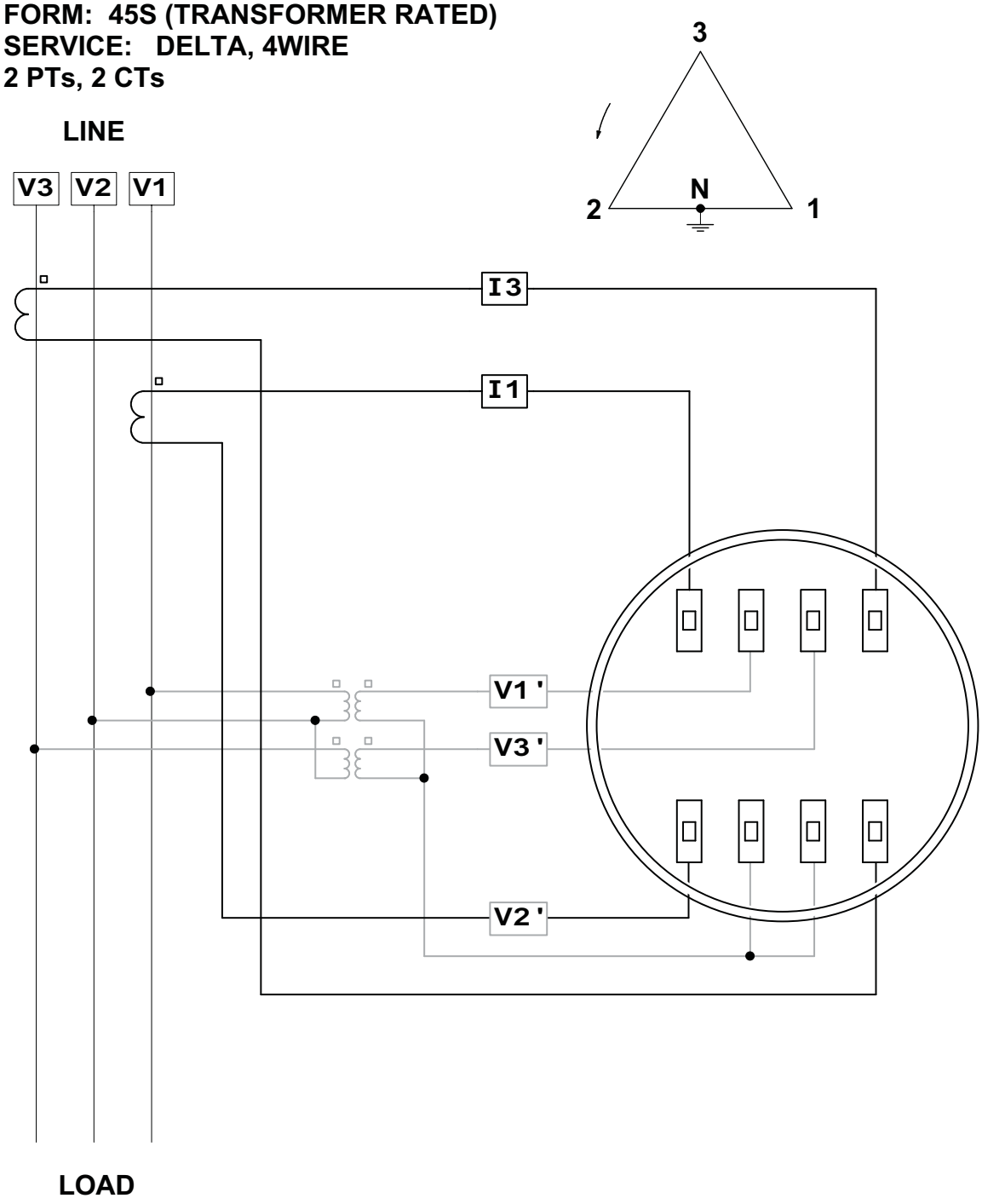


Figure 11.18: Form 45S 4-Wire Delta, 2 PTs, 2 CTs

- The protective ground connections for the transformers are omitted in the diagrams and are not required for the meter to work properly. However, we strongly recommend those connections to reduce shock hazard.
- Shorting switches (blocks) for the current transformers' secondary side are also not shown. To prevent electrical shock we recommended you use such shorting switches (blocks). Make sure the CTs' secondary are shorted before disconnecting them from the meter's current input terminals.

11.4: 9S Meter Mounted in S/A Adapter

Any of the 9S Forms can be mounted in an S/A Adapter, such as the one shown below. The socket meter is “pushed” into the S/A Adapter until the meter “snaps” into place. The blades on the back of the socket meter make the proper connection. See Figures 11.1 to 11.8 for the 9S wiring diagrams.

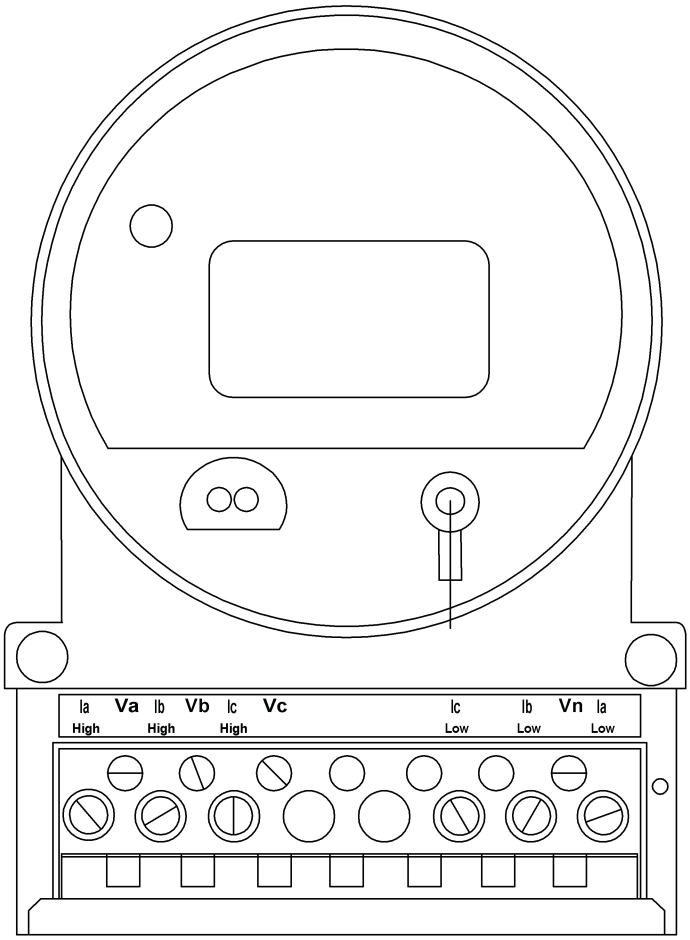


Figure 11.19: Form 9S mounted in an S/A Adapter (front removed)

This page intentionally left blank

12: Switchboard Meter

12.1: Introduction

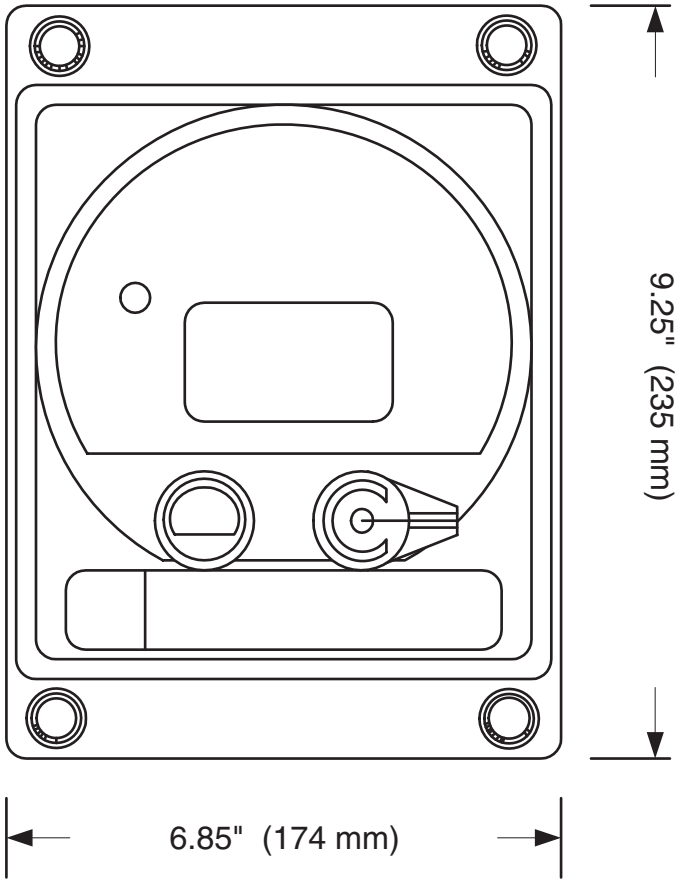


Figure 12.1: Switchboard Meter Dimensions, Front

This chapter gives you a brief overview of the Nexus® 1262/1272 Switchboard option. The Switchboard meter gives you all the features of the Socket meter in a compact case. Easy installation or disconnection is the primary benefit of choosing this option. The Switchboard system lets you install or “rack out” the meter in two easy steps. Minimal manual wiring is required to connect or disconnect the meter.

The Switchboard meter operates in the same way as the Socket meter.

There are a few differences between the two meter options:

- The labels on the face and the shroud of the meter will be slightly different, depending on options selected (see Section 12.2 for label detail)

- The wiring Forms are 9Z and 36Z and the wiring is different (see Section 12.5)
- Dimensions are different (see Section 12.3)
- Installation is different (and even easier!) (see Section 12.4)

CAUTION! The Power Supply Input on the Switchboard unit is configured differently. Please check wiring carefully.

12.2: Labels

The labels on the Switchboard meter are similar to those on the Socket meter. Forms are 9Z and 36Z and there may be some additional items, depending upon the options selected. See Chapter 3 for a description of the components on the front and shroud labels.

Figure 12.2: Switchboard Meter, Front View

Mfg. Date:	2/2/2011	**Serial#:**	40/83003
Model:	NEXUS 1262S-SWB-20-60HZ-4IPO-INP2		
Memory:	4 Meg:	**Options:**	NONE
Freq.:	50Hz	**KYZ Out:**	NO
Opt. Comm:	No Optional Com		
Power Supply:	56-82.8V AC		
Notes:			

www.electroind.com

Figure 12.3: Sample of Switchboard Options Label

12.3: Specifications and Dimensions

The Switchboard meter specifications are the same as those of the Socket meter, except for meter dimensions. The Switchboard meter is essentially the Socket meter in an oblong case. The dimensions are given in figures 12.1 (Front View), 12.4 (Back View) and 12.5 (Side View). See Chapter 2 for meter specifications.

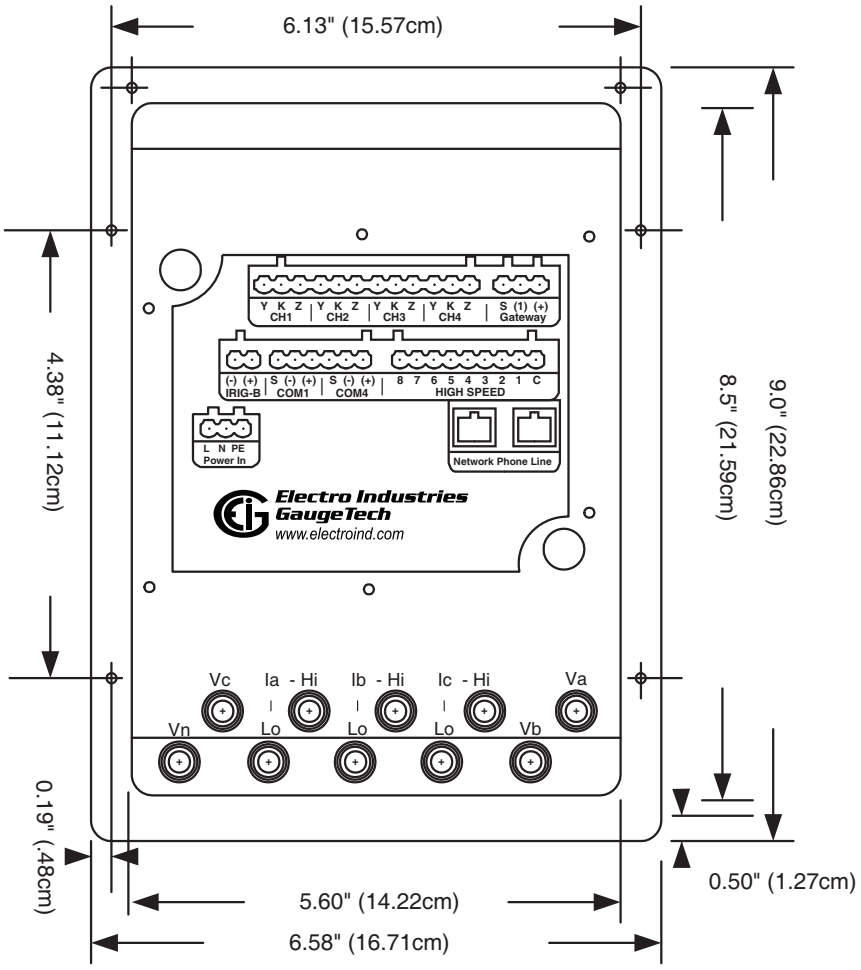


Figure 12.4: Switchboard Meter Dimensions, Back

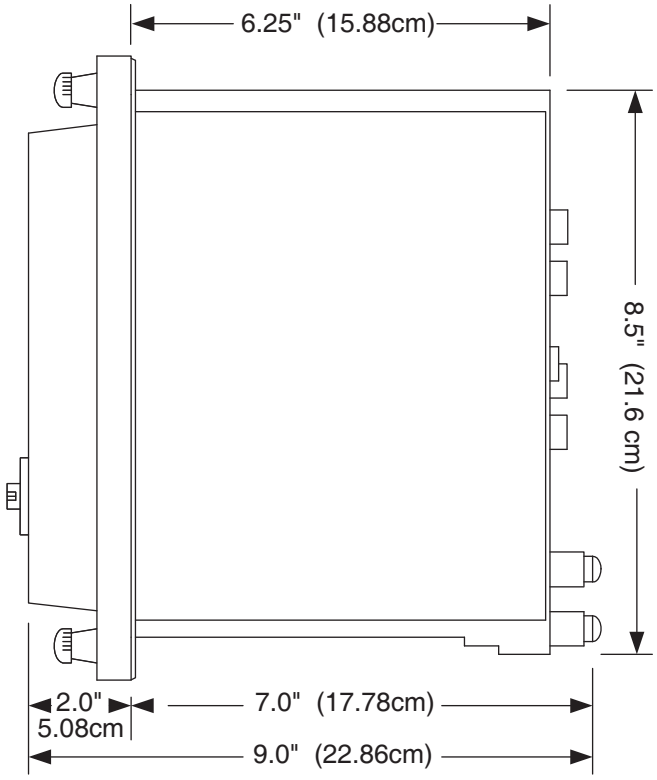


Figure 12.5: Switchboard Meter Dimensions, Side

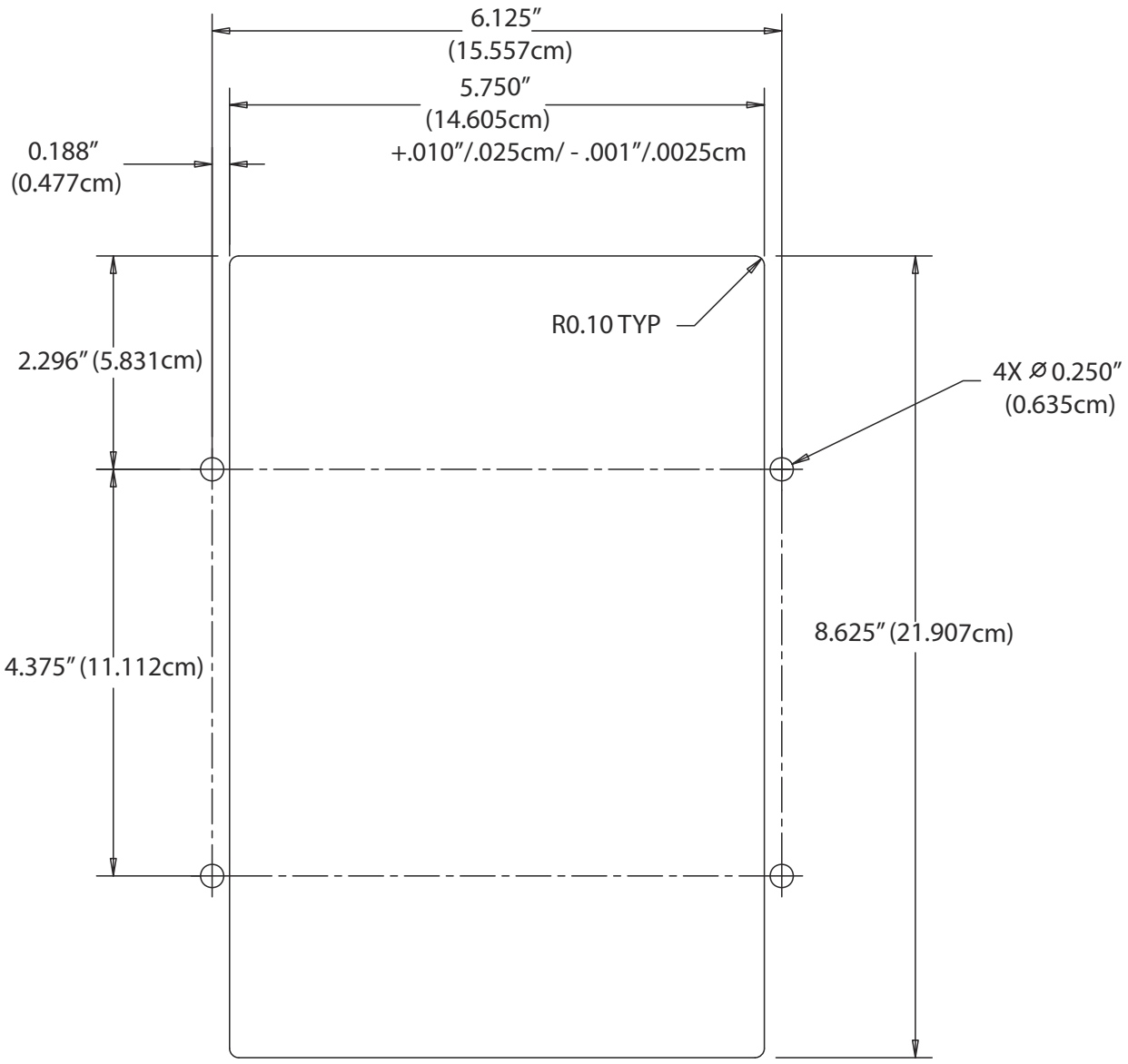


Figure 12.6: Switchboard Meter Cutout

IMPORTANT! Check drill holes for the mounting screw you are using, to insure that the mounting screw fits the box tightly enough to hold the box in place. You can use a washer for a slightly smaller mounting screw.

12.4: Installation

The Switchboard meter provides easy installation and removal from installation. **IMPORTANT!** Before installing the meter, check the battery connections (see Sections 6.2 and 5.4.4).

1. Insert the case into a prepared mounting hole. Secure with mounting screws.

2. Slide the meter into the case and secure it by sliding the chassis levers until they snap into place. Connectors for the following are located on the back of the meter. The connectors automatically plug into the available connectors on the mounting board (see Figure 12.8).

   - Pulse Outputs - Four Channels
   - Status Inputs
   - Phone
   - Line/Network
   - Power In
   - COM4, COM1
   - IRIG-B
   - Modem Gateway RS485

3. Position the Switchboard case front against the four screw holes and secure it by turning the four built-in screws in each of the corners. See Figure 12.7.

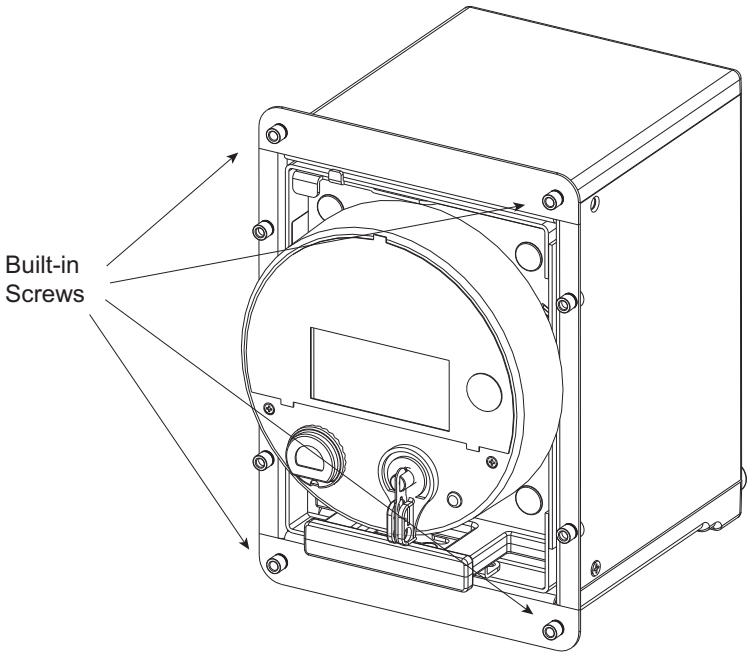


Figure 12.7: Switchboard Case Front Showing 4 Screw Holes

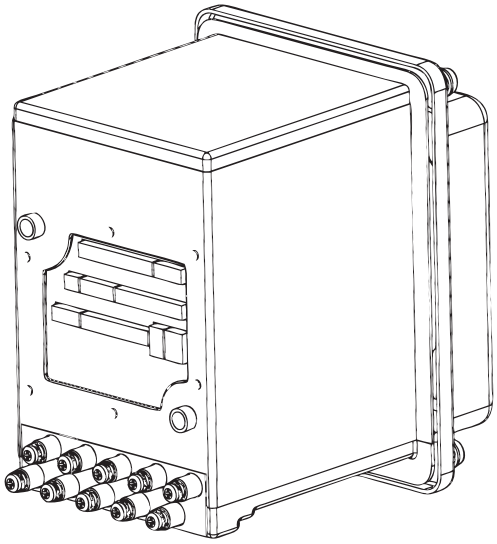


Figure 12.8: Switchboard Meter Back Showing Connectors

12.5: Wiring Diagrams

The wiring of the Switchboard meter is similar to that of the Socket meter.

Form	Description	Figure#
9Z	Wye, no PTs, 3 CTs	12.9
	Wye, 3 PTs, 3 CTs	12.10
	4-Wire Delta, no PTs, 3 CTs	12.11
	4-Wire Delta, 3 PTs, 3 CTs	12.12
	3-Wire Delta, no PTs, 2 CTs	12.13
	3-Wire Delta, 2 PTs, 2 CTs	12.14
	3-Wire Delta, no PTs, 2 CTs	12.15
	3-Wire Delta, 2 PTs, 2 CTs	12.16
	3-Wire Delta, 2 PTs, 3 CTs	12.19
	3-Wire Delta, no PTs, 3 CTs	12.20
36Z	2.5 EL Wye, no PTs, 3 CTs	12.17
	2.5 EL Wye, 2 PTs, 3 CTs	12.18

Table 12.1: Switchboard Meter Configurations

The meter snaps into place and is secured with levers and screws. All input and output connections are made automatically as the meter is installed. (Refer to Section 12.4 and Figure 12.8.)

Wiring options are shown in Figures 12.9 through 12.20.

NOTE: For special requirements, contact our service department.

CAUTION! All wiring should be done by a licensed professional. Actual installation procedures, materials, equipment and connections must conform to applicable codes and standards. **See Section 11.1 for important safety considerations.**

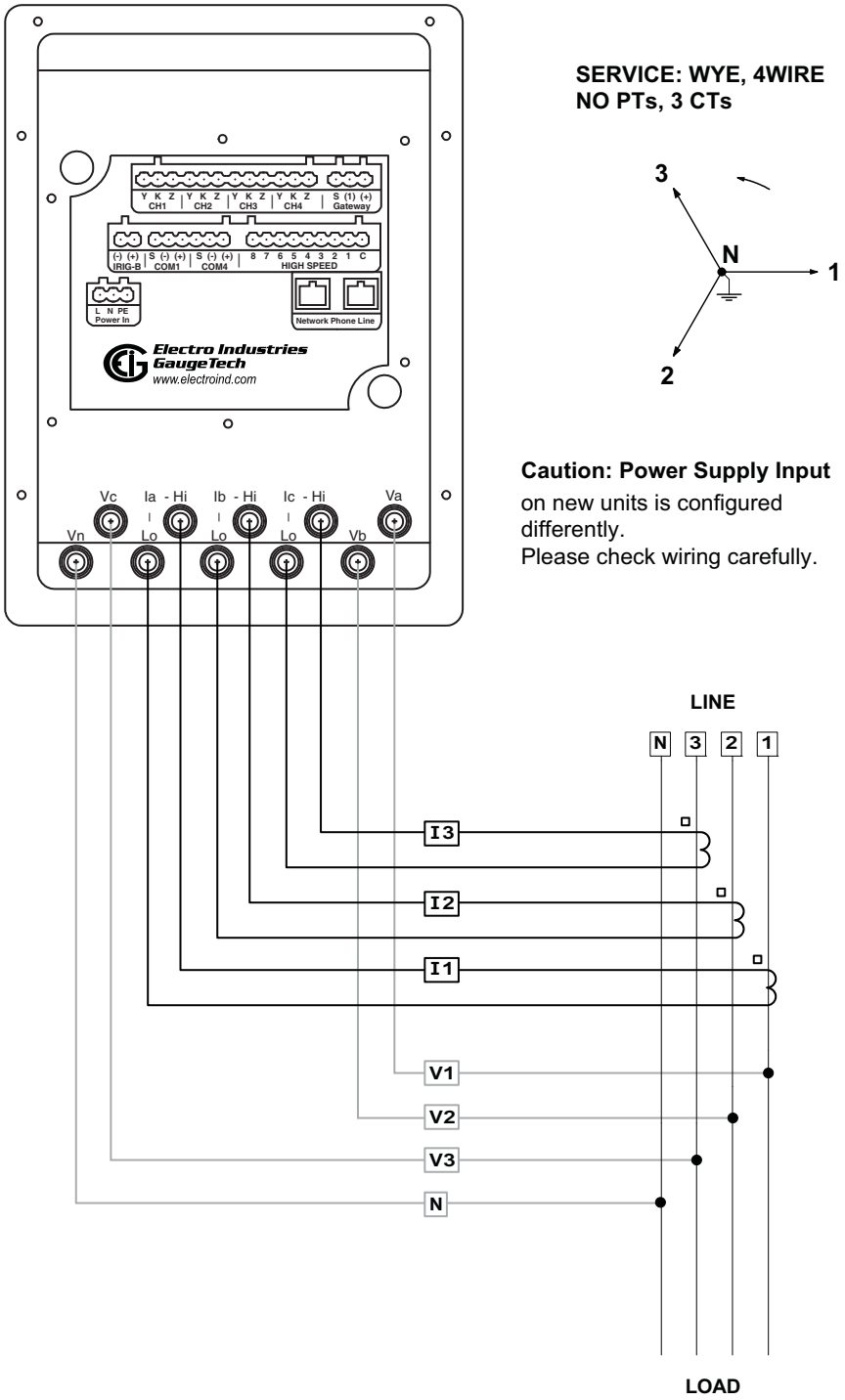


Figure 12.9: 9Z Transformer Rated Wye, no PTs, 3 CTs

- The protective ground connections for the transformers are omitted in the diagrams and are not required for the meter to work properly. However, we strongly recommend those connections to reduce shock hazard.
- Shorting switches (blocks) for the current transformers' secondary side are also not shown. To prevent electrical shock we recommended you use such shorting switches (blocks). Make sure the CTs' secondary are shorted before disconnecting them from the meter's current input terminals.

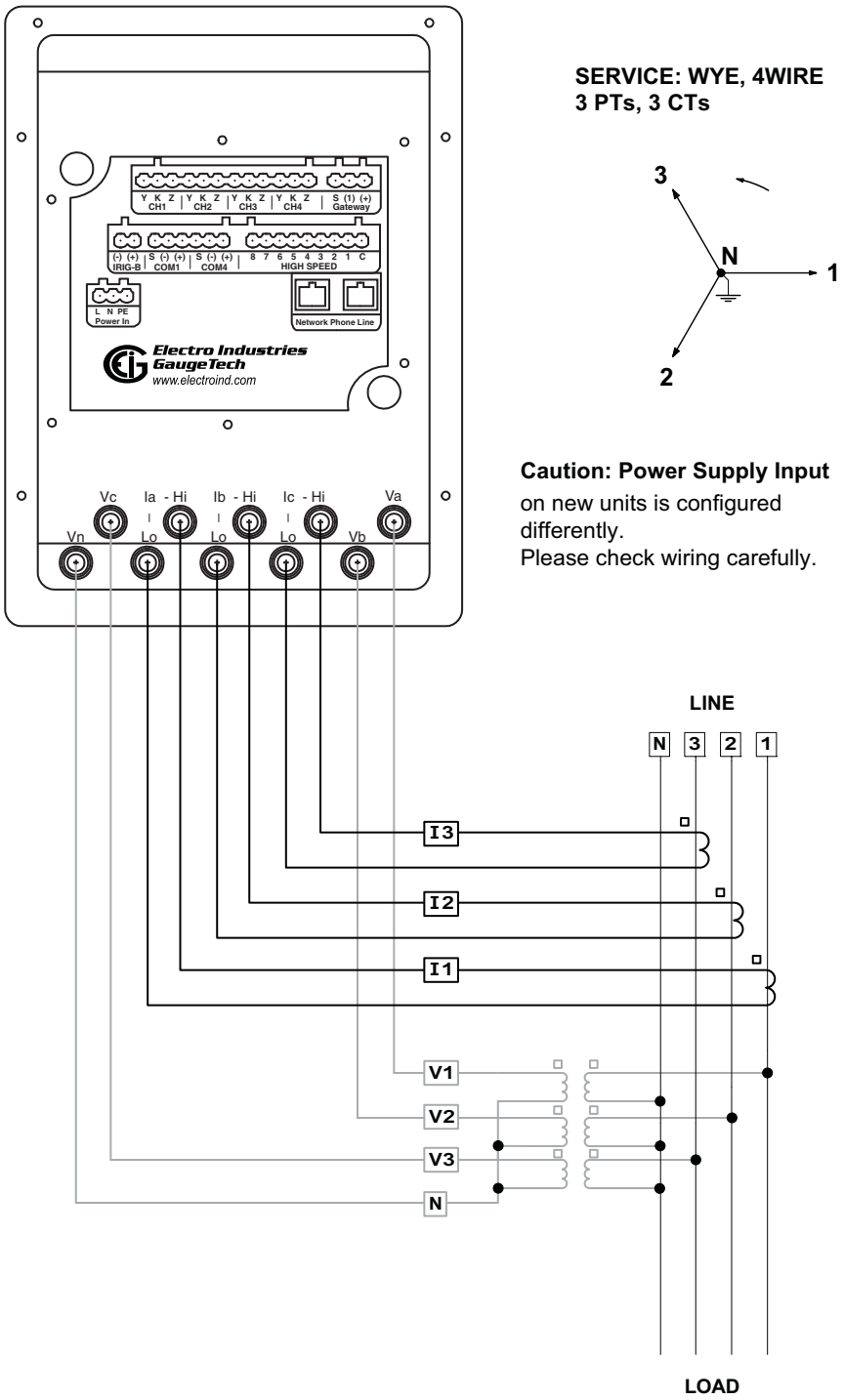


Figure 12.10: 9Z Transformer Rated Wye, 3 PTs, 3 CTs

- The protective ground connections for the transformers are omitted in the diagrams and are not required for the meter to work properly. However, we strongly recommend those connections to reduce shock hazard.
- Shorting switches (blocks) for the current transformers' secondary side are also not shown. To prevent electrical shock we recommended you use such shorting switches (blocks). Make sure the CTs' secondary are shorted before disconnecting them from the meter's current input terminals.

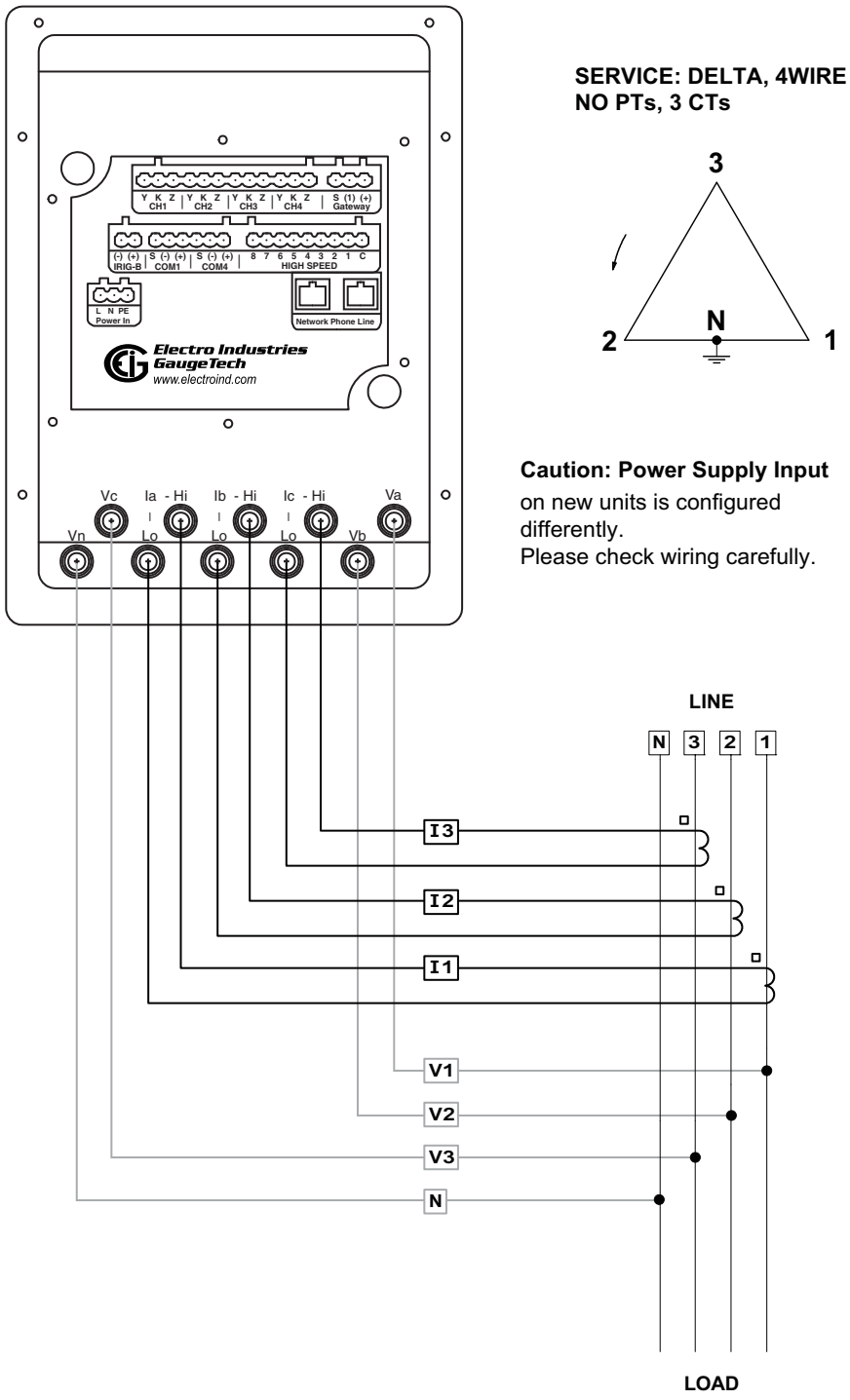


Figure 12.11: 9Z Transformer Rated 4-Wire Delta, no PTs, 3 CTs

- The protective ground connections for the transformers are omitted in the diagrams and are not required for the meter to work properly. However, we strongly recommend those connections to reduce shock hazard.
- Shorting switches (blocks) for the current transformers' secondary side are also not shown. To prevent electrical shock we recommended you use such shorting switches (blocks). Make sure the CTs' secondary are shorted before disconnecting them from the meter's current input terminals.

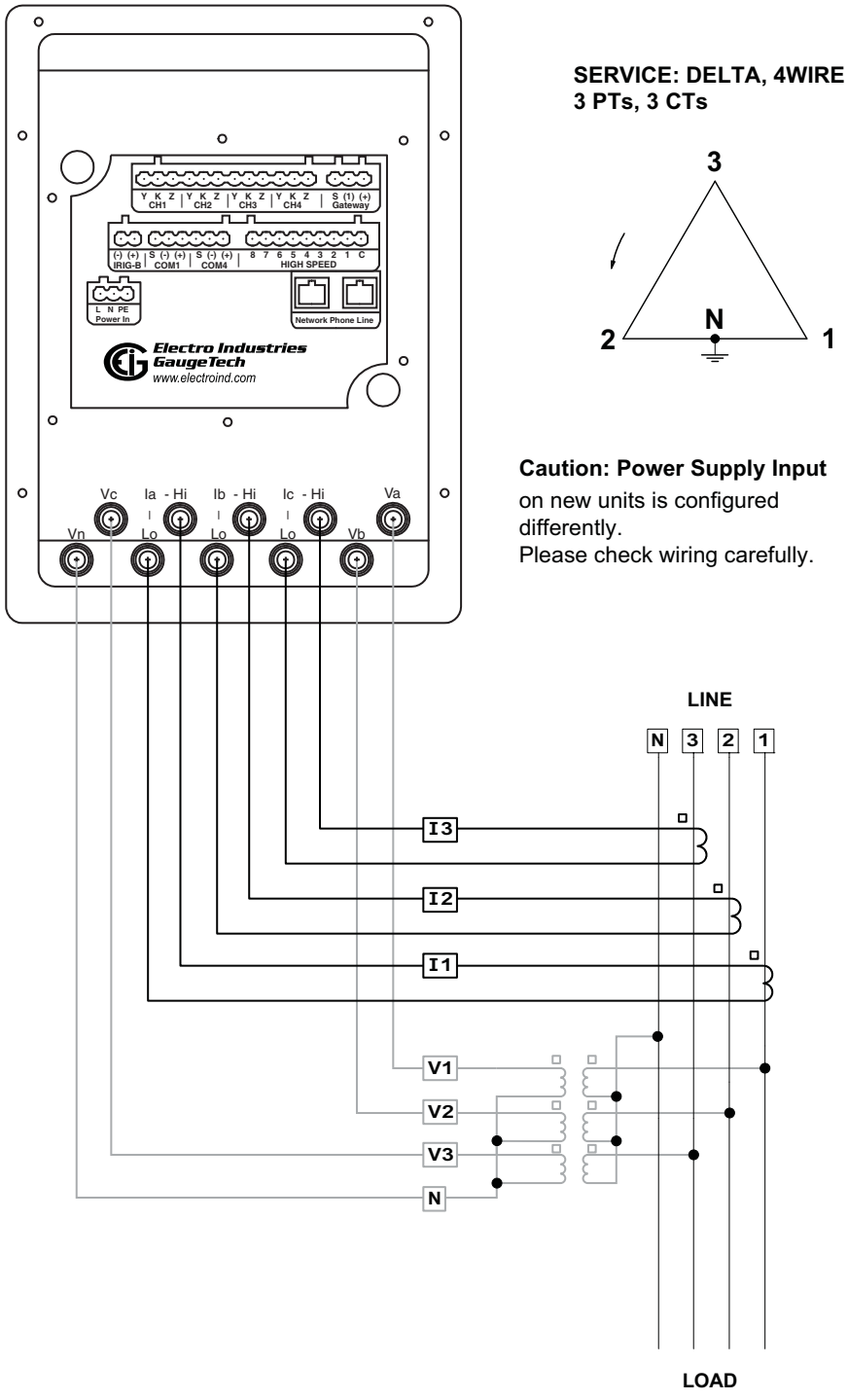


Figure 12.12: 9Z Transformer Rated 4-Wire Delta, 3 PTs, 3 CTs

- The protective ground connections for the transformers are omitted in the diagrams and are not required for the meter to work properly. However, we strongly recommend those connections to reduce shock hazard.
- Shorting switches (blocks) for the current transformers' secondary side are also not shown. To prevent electrical shock we recommended you use such shorting switches (blocks). Make sure the CTs' secondary are shorted before disconnecting them from the meter's current input terminals.

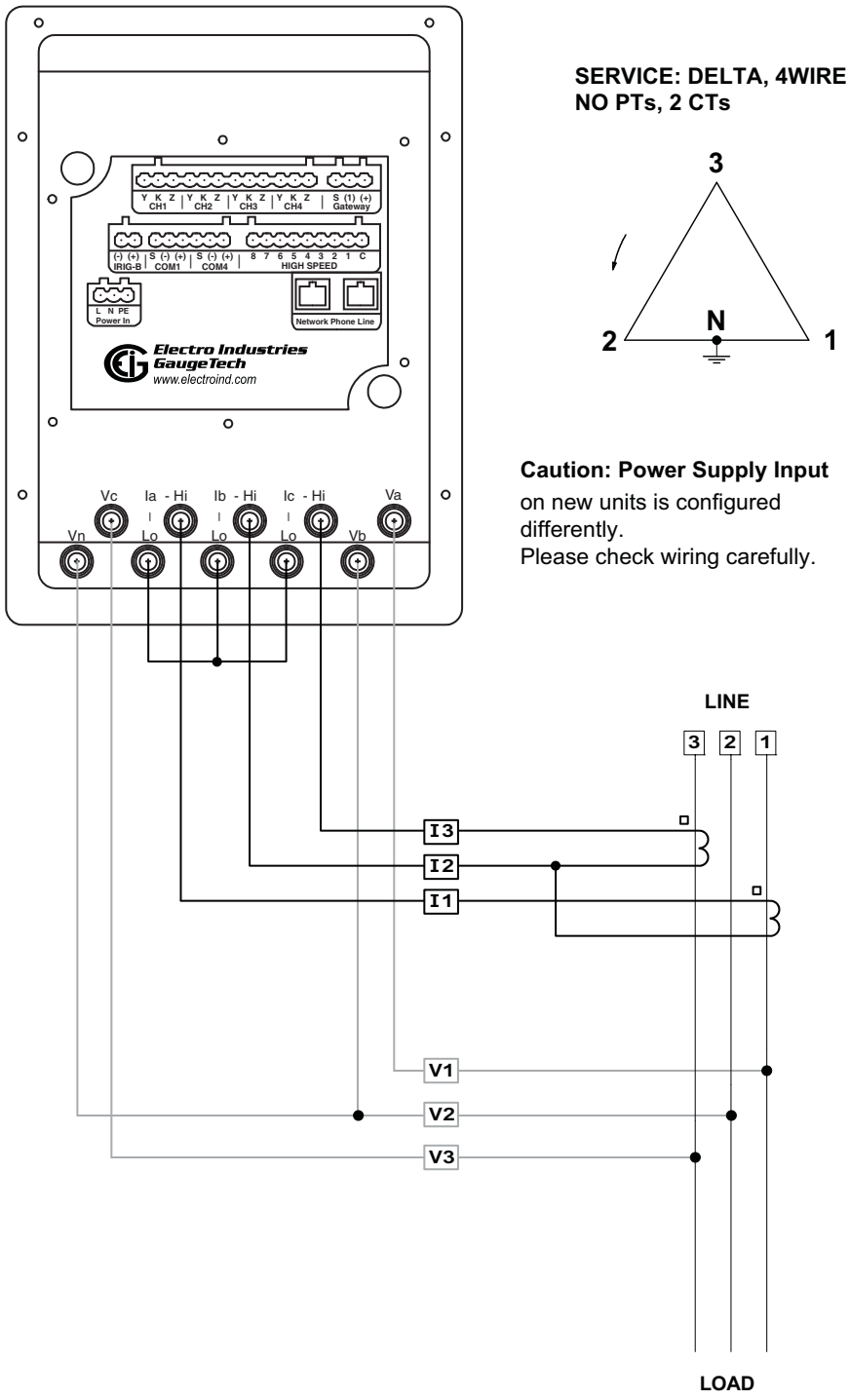


Figure 12.13: 9Z Transformer Rated 3-Wire Delta, no PTs, 2 CTs

- The protective ground connections for the transformers are omitted in the diagrams and are not required for the meter to work properly. However, we strongly recommend those connections to reduce shock hazard.
- Shorting switches (blocks) for the current transformers' secondary side are also not shown. To prevent electrical shock we recommended you use such shorting switches (blocks). Make sure the CTs' secondary are shorted before disconnecting them from the meter's current input terminals.

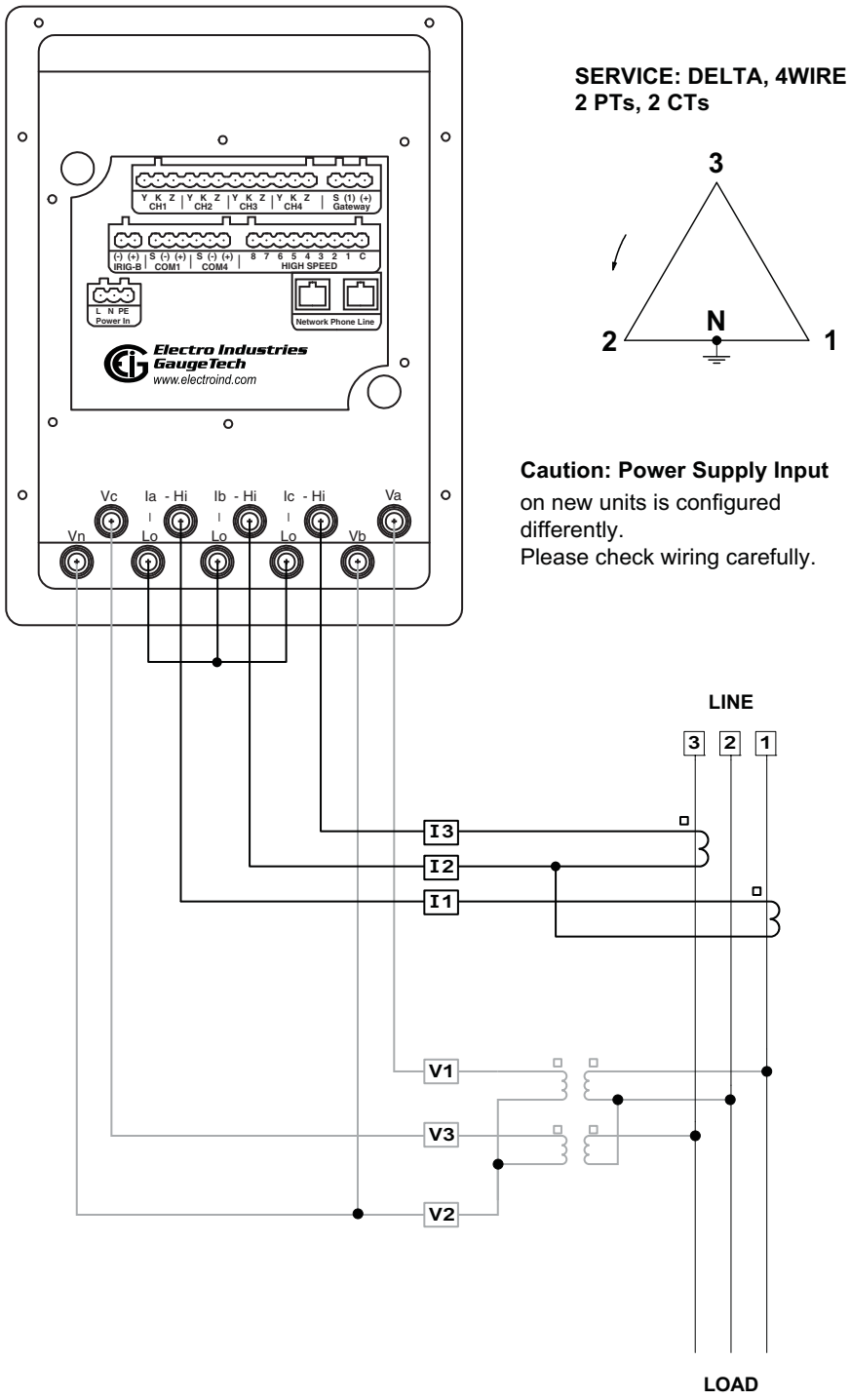


Figure 12.14: 9Z Transformer Rated 3-Wire Delta, 2 PTs, 2 CTs

- The protective ground connections for the transformers are omitted in the diagrams and are not required for the meter to work properly. However, we strongly recommend those connections to reduce shock hazard.
- Shorting switches (blocks) for the current transformers' secondary side are also not shown. To prevent electrical shock we recommended you use such shorting switches (blocks). Make sure the CTs' secondary are shorted before disconnecting them from the meter's current input terminals.

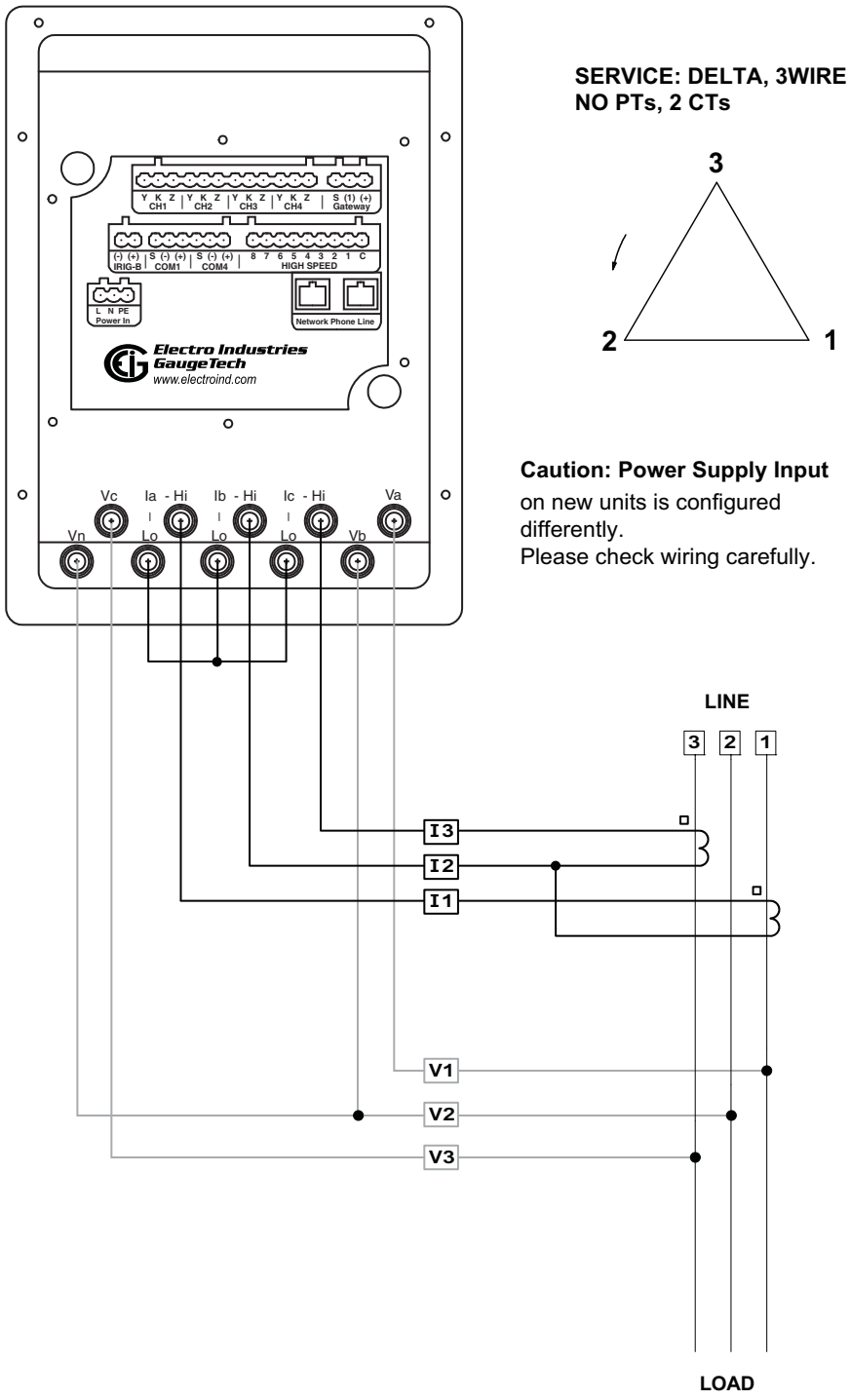


Figure 12.15: 9Z Transformer Rated 3-Wire Delta, no PTs, 2 CTs

- The protective ground connections for the transformers are omitted in the diagrams and are not required for the meter to work properly. However, we strongly recommend those connections to reduce shock hazard.
- Shorting switches (blocks) for the current transformers' secondary side are also not shown. To prevent electrical shock we recommended you use such shorting switches (blocks). Make sure the CTs' secondary are shorted before disconnecting them from the meter's current input terminals.

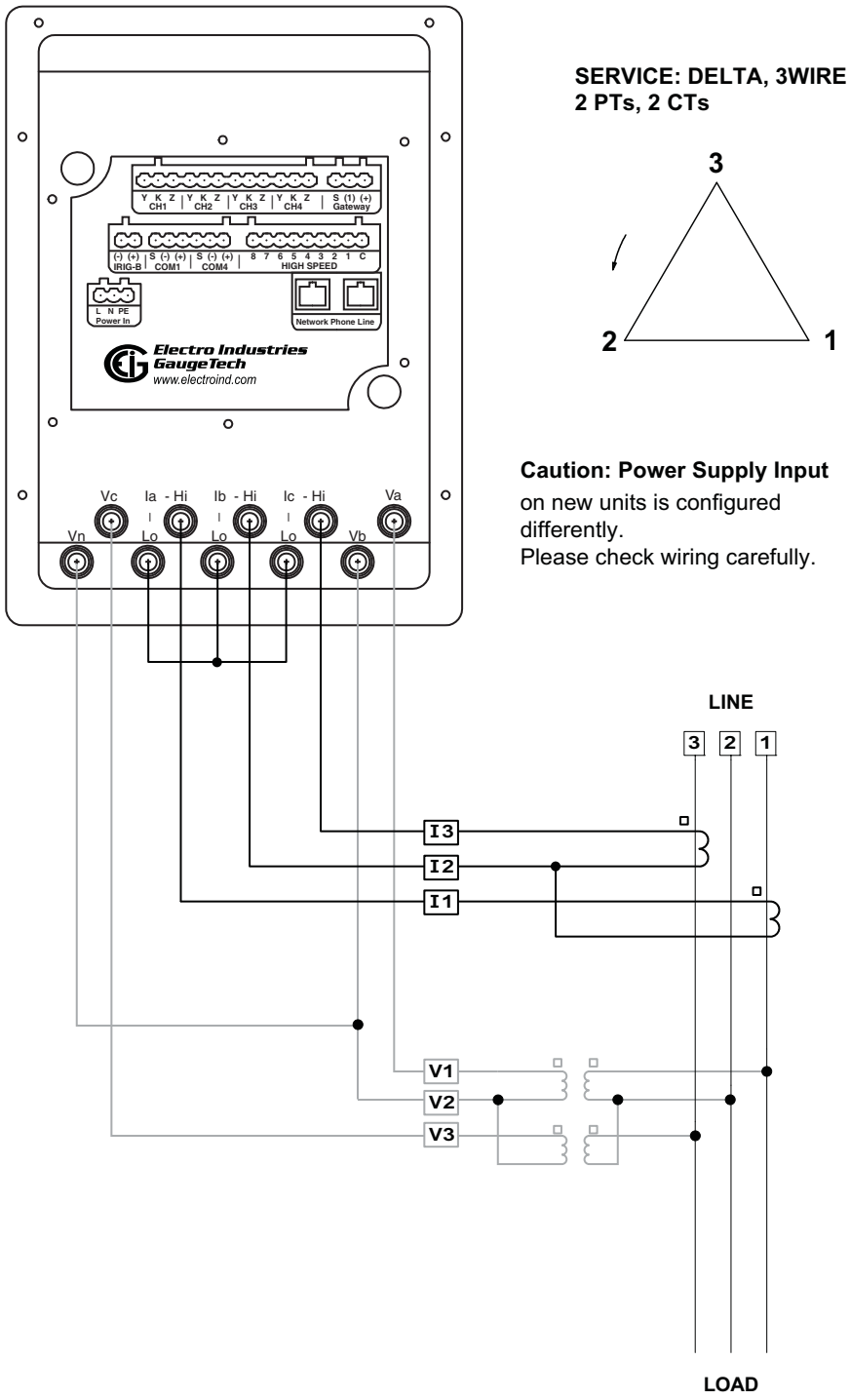


Figure 12.16: 9Z Transformer Rated 3-Wire Delta, 2 PTs, 2 CTs

- The protective ground connections for the transformers are omitted in the diagrams and are not required for the meter to work properly. However, we strongly recommend those connections to reduce shock hazard.
- Shorting switches (blocks) for the current transformers' secondary side are also not shown. To prevent electrical shock we recommended you use such shorting switches (blocks). Make sure the CTs' secondary are shorted before disconnecting them from the meter's current input terminals.

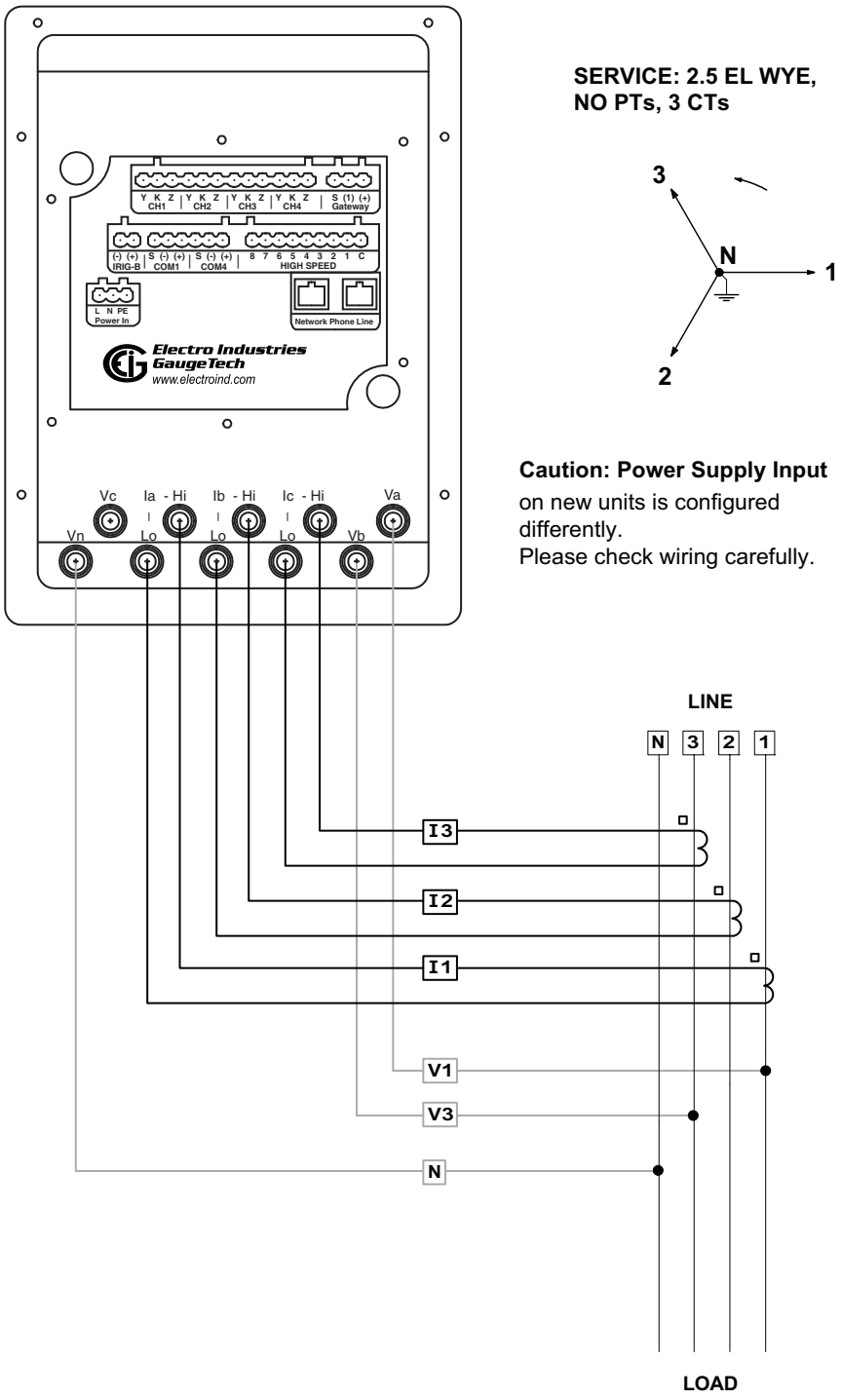


Figure 12.17: 36Z 2.5 Element Wye, no PTs, 3 CTs

- The protective ground connections for the transformers are omitted in the diagrams and are not required for the meter to work properly. However, we strongly recommend those connections to reduce shock hazard.
- Shorting switches (blocks) for the current transformers' secondary side are also not shown. To prevent electrical shock we recommended you use such shorting switches (blocks). Make sure the CTs' secondary are shorted before disconnecting them from the meter's current input terminals.

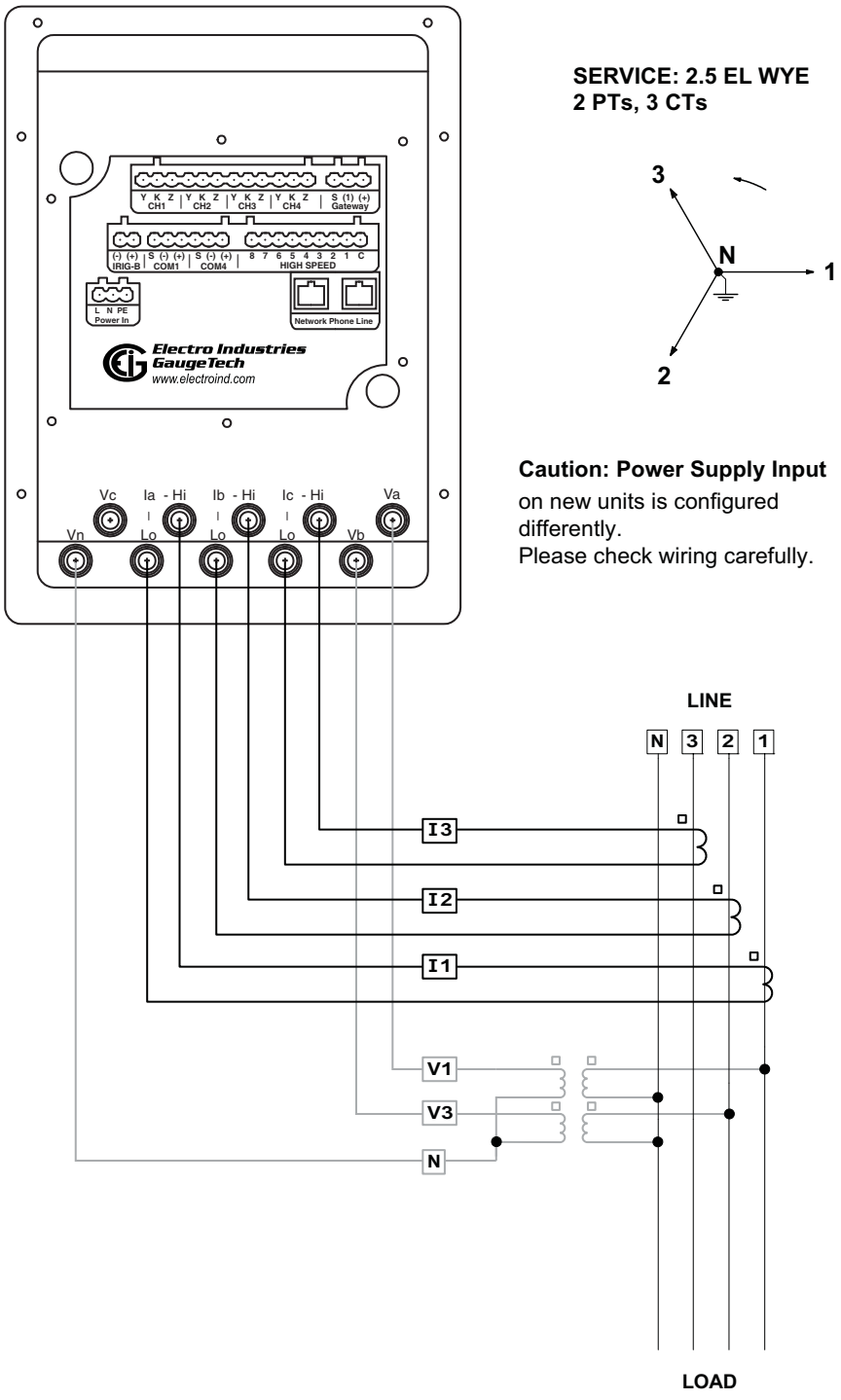


Figure 12.18: 36Z 2.5 Element Wye, 2 PTs, 3 CTs

- The protective ground connections for the transformers are omitted in the diagrams and are not required for the meter to work properly. However, we strongly recommend those connections to reduce shock hazard.
- Shorting switches (blocks) for the current transformers' secondary side are also not shown. To prevent electrical shock we recommended you use such shorting switches (blocks). Make sure the CTs' secondary are shorted before disconnecting them from the meter's current input terminals.

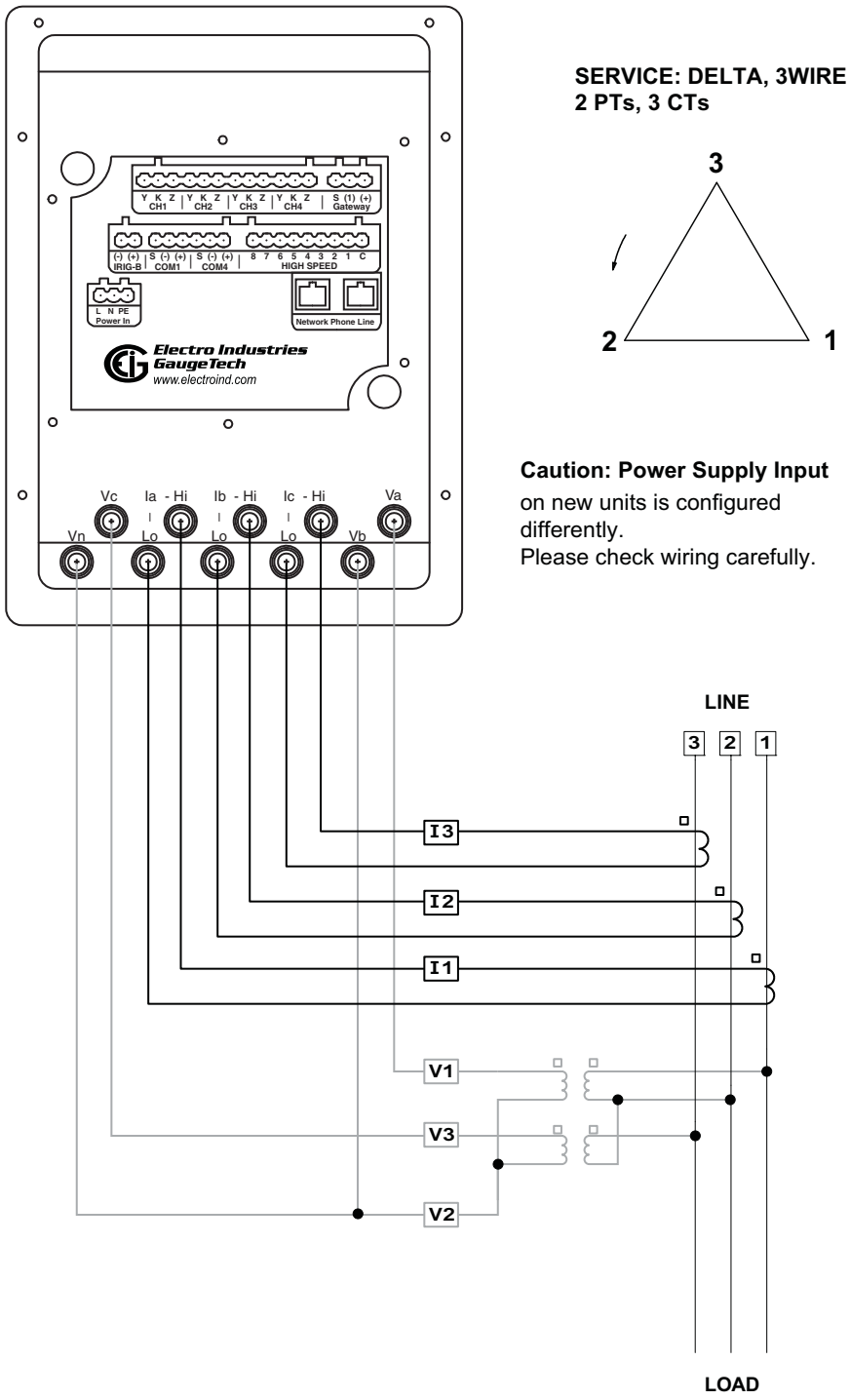


Figure 12.19: Delta, 3-wire, 2 PTs, 3 CTs

- The protective ground connections for the transformers are omitted in the diagrams and are not required for the meter to work properly. However, we strongly recommend those connections to reduce shock hazard.
- Shorting switches (blocks) for the current transformers' secondary side are also not shown. To prevent electrical shock we recommended you use such shorting switches (blocks). Make sure the CTs' secondary are shorted before disconnecting them from the meter's current input terminals.

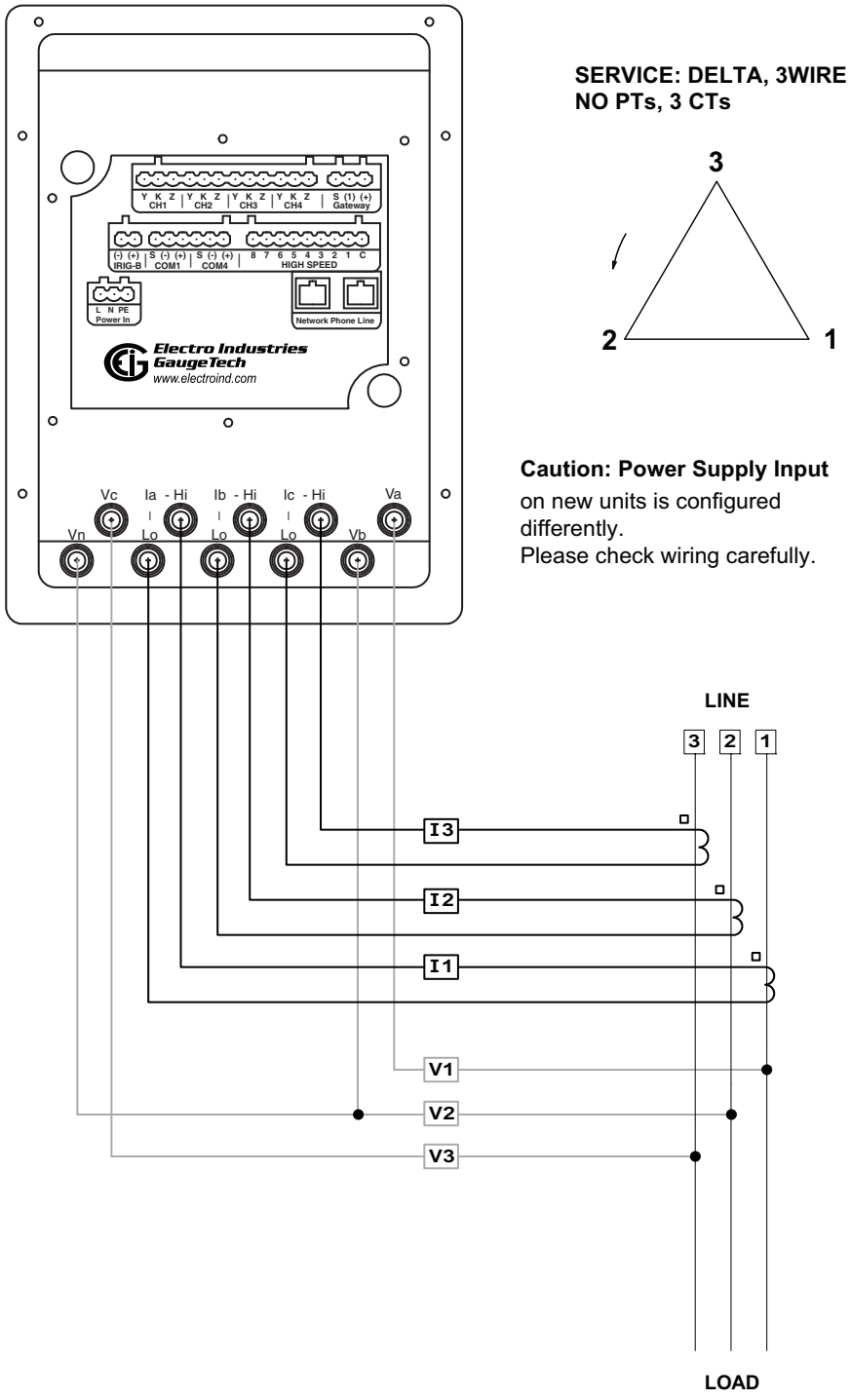


Figure 12.20: Delta, 3-wire, No PTs, 3 CTs

- The protective ground connections for the transformers are omitted in the diagrams and are not required for the meter to work properly. However, we strongly recommend those connections to reduce shock hazard.
- Shorting switches (blocks) for the current transformers' secondary side are also not shown. To prevent electrical shock we recommended you use such shorting switches (blocks). Make sure the CTs' secondary are shorted before disconnecting them from the meter's current input terminals.

13: Meter Calculations

13.1: Measurements and Calculations

The Nexus® 1262/1272 Meter measures many different power parameters. Following is a list of the formulas used to perform calculations with samples for Wye and Delta services.

Samples for Wye: v_a, v_b, v_c, i_a, i_b, i_c, i_n

Samples for Delta: v_{ab}, v_{bc}, v_{ca}, i_a, i_b, i_c

Root Mean Square (RMS) of Phase Voltages: N = number of samples

For Wye: x = a, b, c

$$V_{RMS_x} = \sqrt{\frac{\sum_{t=1}^{N} v_{x(t)}^2}{N}}$$

Root Mean Square (RMS) of Line Currents: N = number of samples

For Wye: x = a, b, c, n

For Delta: x = a, b, c

$$I_{RMS_x} = \sqrt{\frac{\sum_{t=1}^{N} i_{x(t)}^2}{N}}$$

Root Mean Square (RMS) of Line Voltages: N = number of samples

For Wye: x, y = a,b or b,c or c,a

$$V_{RMS_{xy}} = \sqrt{\frac{\sum_{t=1}^{N} (v_{x_{(t)}} - v_{y_{(t)}})^2}{N}}$$

For Delta: xy = ab, bc, ca

$$V_{RMS_{xy}} = \sqrt{\frac{\sum_{t=1}^{N} v_{xy(t)}^2}{N}}$$

Power (Watts) per phase: N = number of samples

For Wye: x = a, b, c

$$W_X = \frac{\sum_{t=1}^{N} v_{x(t)} \bullet i_{x(t)}}{N}$$

Apparent Power (VA) per phase:

For Wye: x = a, b, c

$$VA_x = V_{RMS_X} \bullet I_{RMS_X}$$

Reactive Power (VAR) per phase:

For Wye: x = a, b, c

$$VAR_x = \sqrt{VA_x^2 - W_x^2}$$

Q per Phase:

For Wye: x = a, b, c

$$Q_x = \frac{\sqrt{3}VAR_x + W_x}{2}$$

Active Power (Watts) Total: N = number of samples

For Wye:

$$W_T = W_a + W_b + W_c$$

For Delta:

$$W_T = \frac{\sum_{t=1}^{N} (v_{ab(t)} \bullet i_{a(t)} - v_{bc(t)} \bullet i_{c(t)})}{N}$$

Reactive Power (VAR) Total: N = number of samples

For Wye:

$$VAR_T = VAR_a + VAR_b + VAR_c$$

For Delta:

$$VAR_T = \sqrt{\left(V_{RMS_{ab}} \bullet I_{RMS_a}\right)^2 - \left[\frac{\sum_{t=1}^{N} v_{ab(t)} \bullet i_{a(t)}}{N}\right]^2} + \sqrt{\left(V_{RMS_{bc}} \bullet I_{RMS_c}\right)^2 - \left[\frac{\sum_{t=1}^{N} v_{bc(t)} \bullet i_{c(t)}}{N}\right]^2}$$

Apparent Power (VA) Total:

For Wye:

$$VA_T = VA_a + VA_b + VA_c$$

For Delta:

$$VA_T = \sqrt{W_T^2 + VAR_T^2}$$

Total Q:

For Wye:

$$Q_T = Q_a + Q_b + Q_c$$

For Delta:

$$Q_T = \frac{\sqrt{3VAR_T + W_T}}{2}$$

Total Energies:

x,y = W_T,Wh_T or VAR_T,$VARh_T$ or VA_T,VAh_T or Q_T,Qh_T

$$y = \frac{\sum x}{3600\,\text{sec.}}$$

Power Factor (PF):

For Wye: x = a, b, c, T

For Delta: x = T

$$PF_x = \frac{W_x}{VA_x}$$

Total Average Power Factor:

x = Quadrants 1 & 4 (positive Wh), Quadrants 2 & 3 (negative Wh)

$$PF_{T\_Avg_x} = \frac{Wh_x}{VAh_x}$$

Phase Angles:

x = a, b, c

$$\angle_x = \cos^{-1}\left(PF_x\right)$$

% Total Harmonic Distortion (%THD):

For Wye: x = v_a, v_b, v_c, i_a, i_b, i_c

For Delta: x = i_a, i_b, i_c, v_{ab}, v_{bc}, v_{ca}

$$THD = \frac{\sqrt{\sum_{h=2}^{127}\left(RMS_{x_h}\right)^2}}{RMS_{x_1}}$$

K Factor:

x = i_a, i_b, i_c

$$KFactor = \frac{\sum_{h=1}^{127}\left(h \bullet RMS_{x_h}\right)^2}{\sum_{h=1}^{127}\left(RMS_{x_h}\right)^2}$$

Voltage Imbalance: N = number of samples

$$\mathrm{Imb}_v = \frac{\sqrt{\frac{\sum_N (v_a + v_b + v_c)}{N}}}{RMS_{v_a} + RMS_{v_b} + RMS_{v_c}}$$

Current Imbalance:

$$\mathrm{Imb}_I = \frac{RMS_{I_{CalcN}}}{RMS_{I_A} + RMS_{I_B} + RMS_{I_C}}$$

13.2: Demand Integrators

Power utilities take into account both energy consumption and peak demand when billing customers. Peak demand, expressed in kilowatts (kW), is the highest level of demand recorded during a set period of time, called the interval. The Nexus® 1262/1272 supports the following most popular conventions for averaging demand and peak demand: Block Window Demand, Rolling Window Demand, Thermal Demand, and Predictive Window Demand. You can program and access all conventions concurrently with the Communicator EXT software (see the *Communicator EXT User Manual*).

Block (Fixed) Window Demand:

This convention records the average (arithmetic mean) demand for consecutive time intervals (usually 15 minutes).

Example: A typical setting of 15 minutes produces an average value every 15 minutes (at 12:00, 12:15. 12:30. etc.) for power reading over the previous fifteen minute interval (11:45-12:00, 12:00-12:15, 12:15-12:30, etc.).

Rolling (Sliding) Window Demand:

Rolling Window Demand functions like multiple overlapping Block Window Demands. The programmable settings provided are the number and length of demand subintervals. At every subinterval, an average (arithmetic mean) of power readings over the subinterval is internally calculated. This new subinterval average is then averaged (arithmetic mean), with as many previous subinterval averages as programmed, to produce the Rolling Window Demand.

Example: With settings of 3 five-minute subintervals, subinterval averages are computed every 5 minutes (12:00, 12:05, 12:15, etc.) for power readings over the previous five-minute interval (11:55-12:00, 12:00-12:05, 12:05-12:10, 12:10-12:15, etc.). Further, every 5 minutes, the subinterval averages are averaged in groups of 3 (12:00. 12:05, 12:10, 12:15. etc.) to produce a fifteen (5x3) minute average every 5 minutes (rolling (sliding) every 5 minutes) (11:55-12:10, 12:00-12:15, etc.).

Thermal Demand:

Traditional analog Watt-hour (Wh) meters use heat-sensitive elements to measure temperature rises produced by an increase in current flowing through the meter. A pointer moves in proportion to the temperature change, providing a record of demand. The pointer remains at peak level until a subsequent increase in demand moves it again, or until it is manually reset. The Nexus® 1262/1272 mimics traditional meters to provide Thermal Demand readings.

Each second, as a new power level is computed, a recurrence relation formula is applied. This formula recomputes the thermal demand by averaging a small portion of the new power value with a large portion of the previous thermal demand value. The proportioning of new to previous is programmable, set by an averaging interval. The averaging interval represents a 90% change in thermal demand to a step change in power.

Predictive Window Demand:

Predictive Window Demand enables the user to forecast average demand for future time intervals. The Nexus® uses the delta rate of change of a Rolling Window Demand interval to predict average demand for an approaching time period. The user can set a relay or alarm to signal when the Predictive Window reaches a specific level, thereby avoiding unacceptable demand levels. The Nexus® 1250/1252 calculates Predictive Window Demand using the following formula:

Example: Using the previous settings of 3 five-minute intervals and a new setting of 120% prediction factor, the working of the Predictive Window Demand could be described as follows:

At 12:10, we have the average of the subintervals from 11:55-12:00, 12:00-12:05 and 12:05-12:10. In five minutes (12:15), we will have an average of the subintervals 12:00-12:05 and 12:05-12:10 (which we know) and 12:10-12:15 (which we do not yet know). As a guess, we will use the last subinterval (12:05-12:10) as an approximation for the next subinterval (12:10-12:15). As a further refinement, we will assume that the next subinterval might have a higher average (120%) than the last subinterval. As we progress into the subinterval, (for example, up to 12:11), the Predictive Window Demand will be the average of the first two subintervals (12:00-12:05, 12:05-12:10), the actual values of the current subinterval (12:10-12:11) and

the prediction for the remainder of the subinterval, 4/5 of the 120% of the 12:05-12:10 subinterval.

# of Subintervals = n

Subinterval Length = Len

Partial Subinterval Length = Cnt

Prediction Factor = Pct

Sub_n		Sub_1	Sub_0	Partial	Predict
Len		Len	Len	Cnt	Len

$$Sub = \frac{\sum_{i=0}^{Len-1} Value_i}{Len}$$

$$Partial = \frac{\sum_{i=0}^{Cnt-1} Value_i}{Cnt}$$

$$\left[Partial + \frac{\sum_{i=0}^{n-2} Value_i}{n} \right] \times \left[1 - \left[\left[\frac{Len - Cnt}{Len} \right] \times Pct \right] \right]$$

$$+\left[\frac{\sum_{i=0}^{n-2} Sub_i}{n-1}+\frac{Sub_0-Sub_{n-1}}{2x(n-1)}\right]\times\left[\left[\frac{Len-Cnt}{Len}\right]\times Pct\right]$$

14: EN50160/IEC61000-4-15 Flicker

14.1: Overview

Flicker is the sensation experienced by the human visual system when subjected to changes in the illumination intensity of light sources. The primary effects of Flicker are headaches and irritability; sometimes Flicker can trigger epileptic fits.

IEC61000-4-15 and former IEC868 describe the methods used to determine Flicker severity. Since this phenomenon is strictly related to the sensitivity and reaction of individuals, it can only be studied on a statistical basis, by setting up suitable experiments among people.

14.2: Theory of Operation

Flicker can be caused by voltage variations which, in turn, are caused by variable loads, such as arc furnaces, laser printers and microwave ovens. In order to model the eye brain change, which is a complex physiological process, the signal from the power network has to be processed while conforming with Figure 14.1, shown on page 14-4.

- Block 1 consists of scaling circuitry and an automatic gain control function that normalizes input Voltages to Blocks 2, 3 and 4. For the specified 50 Hz operation, the Voltage standard is 230 V RMS.

- Block 2 recovers the Voltage fluctuation by squaring the input Voltage scaled to the reference level. This simulates the behavior of a lamp.

- Block 3 is composed of a cascade of two filters and a measuring range selector. In this implementation, a log classifier covers the full scale in use so the gain selection is automatic and not shown here. The first filter eliminates the DC component and the double mains frequency components of the demodulated output. The configuration consists of a .05 Hz Low High Pass filter and a 6 Pole Butterworth Low Pass filter located at 35 Hz. The second filter is a weighting filter that simulates the response of the human visual system to sinusoidal Voltage fluctuations of a coiled filament, gas-filled lamp (60 W - 230 V). The filter implementation of this function is as specified in IEC 61000-4-15.

- Block 4 is composed of a squaring multiplier and a Low Pass filter. The Human Flicker Sensation via lamp, eye and brain is simulated by the combined non-linear response of Blocks 2, 3 and 4.

- Block 5 performs an online statistical cumulative probability analysis of the flicker level. Block 5 allows direct calculation of the evaluation parameters Pst and Plt.

Flicker is computed using the three phase-to-neutral Voltages in Wye configurations and the three phase-to-phase Voltages when in Delta. Evaluation occurs in the following forms: Instantaneous, Short Term or Long Term.

- Instantaneous Flicker Evaluation: An output of 1.00 from Block 4 corresponds to the Reference Human Flicker Perceptibility Threshold for 50% of the population. This value is measured in Perceptibility Units (PU) and is labeled Pinst. This is a real time value and it is continuously updated.

- Short Term Flicker Evaluation: An output of 1.00 from Block 5 (corresponding to the Pst value) corresponds to the conventional threshold of irritability per IEC 1000-3-3. In order to evaluate flicker severity, two parameters have been defined: one for the short term called Pst (defined in this section) and one for the long term called Plt (defined in the next section).

  The standard measurement time for Pst is 10 minutes. Pst is derived from the time at level statistics obtained from the level classifier in Block 5 of the flicker meter. The following formula is used:

$$P_{st} = \sqrt{0.0314P_{0.1} + 0.0525P_{1s} + 0.0657P_{3s} + 0.28P_{10s} + 0.08P_{50s}}$$

  ,where the percentiles P(0.1), P(1), P(3), P(10), P(50) are the flicker levels exceeded for 0.1, 1, 2, 20 and 50% of the time during the observation period. The suffix S in the formula indicates that the smoothed value should be used. The smoothed values are obtained using the following formulas:

  P(1s) = (P(.7) + P(1) + P(1.5))/3

  P(3s) = (P(2.2) + P(3) + P(4))/3

  P(10s) = (P(6) + P(8) + P(10) + P(13) + P(17))/5

  P(50s) = (P(30) + P(50) + P(80))/3

The .3-second memory time constant in the flicker meter ensures that P(0.1) cannot change abruptly and no smoothing is needed for this percentile.

- Long Term Flicker Evaluation: The 10-minute period on which the short-term flicker severity is based is suitable for short duty cycle disturbances. For flicker sources with long and variable duty cycles (e.g. arc furnaces) it is necessary to provide criteria for long-term assessment. For this purpose, the long-term Plt is derived from the short-term values over an appropriate period. By definition, this is 12 short-term values of 10 minutes each over a period of 2 hours. The following formula is used:

$$P_{lt} = \sqrt[3]{\frac{\sum_{i=1}^{N} P_{sti}^3}{N}}$$

,where Psti (i = 1, 2, 3...) are consecutive readings of the short-term severity Pst.

14.2.1: Summary:

Flicker = Changes in the illumination of light sources due to cyclical Voltage variations.

Pinst = Instantaneous flicker values in Perceptibility Units (PU).

Pst = Value based on 10-minute analysis.

Plt = Value based on 12 Pst values.

Measurement Procedure:

1. Original Signal with amplitude variations.

2. Square demodulator.

3. Weighted filter.

4. Low pass filter 1st order.

5. Statistical computing.

Data available:

- Pst, Pst Max, Pst Min values for long term recording
- Plt, Plt Max, Plt Min values for long term recording

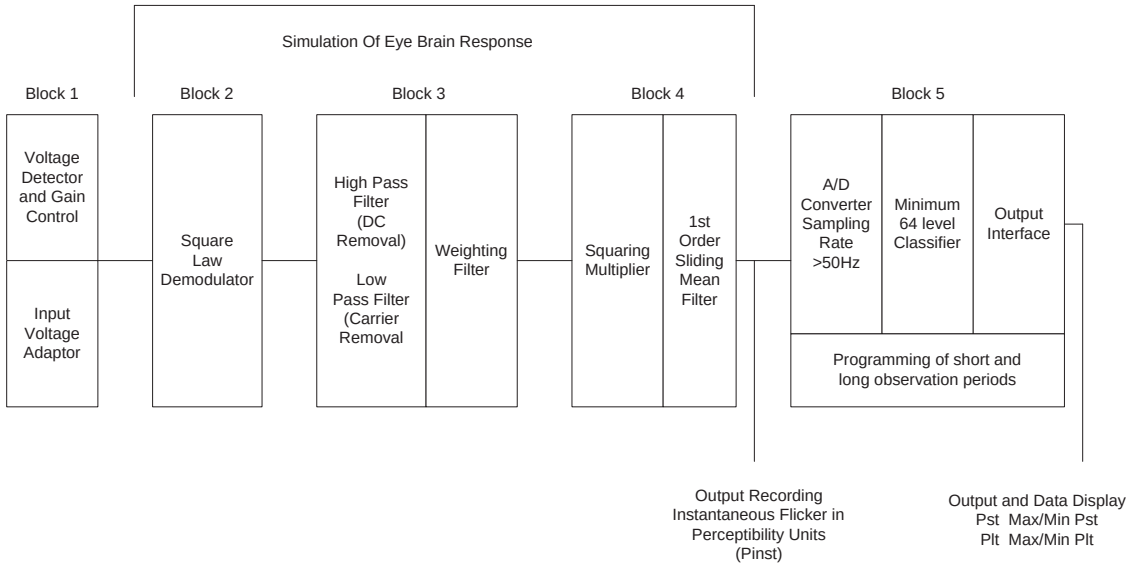
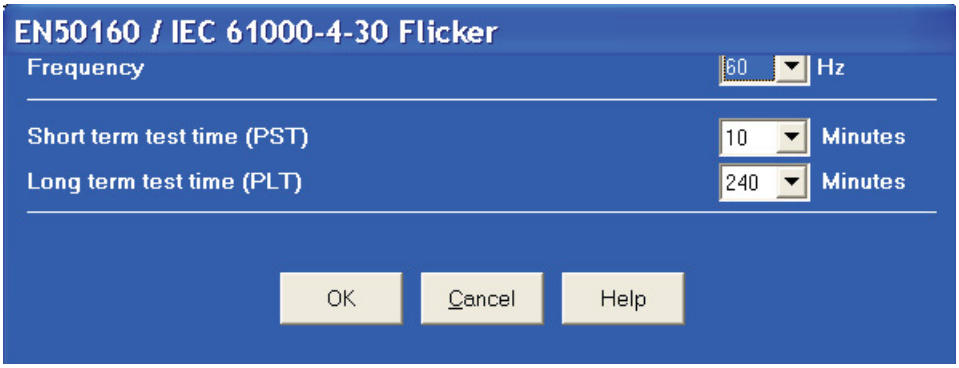


Figure 14.1: Simulation of Eye Brain Response

14.3: Flicker Setup

You must set up several parameters to properly configure Flicker.

1. Select the **Profile** icon from Communicator EXT's Icon bar.
2. From the Device Profile screen, double-click **Power Quality and Alarm Settings>EN50160/IEC61000-4-30 Flicker**. You will see the screen shown below.



- Select the Frequency of operation. 50 Hz is the approved frequency according to Flicker standards. A 60 Hz implementation is available and can be selected. Remember the Voltage is normalized. For 50 Hz, the normalized Voltage is 230 V and for 60 Hz, the normalized Voltage is 120 V.

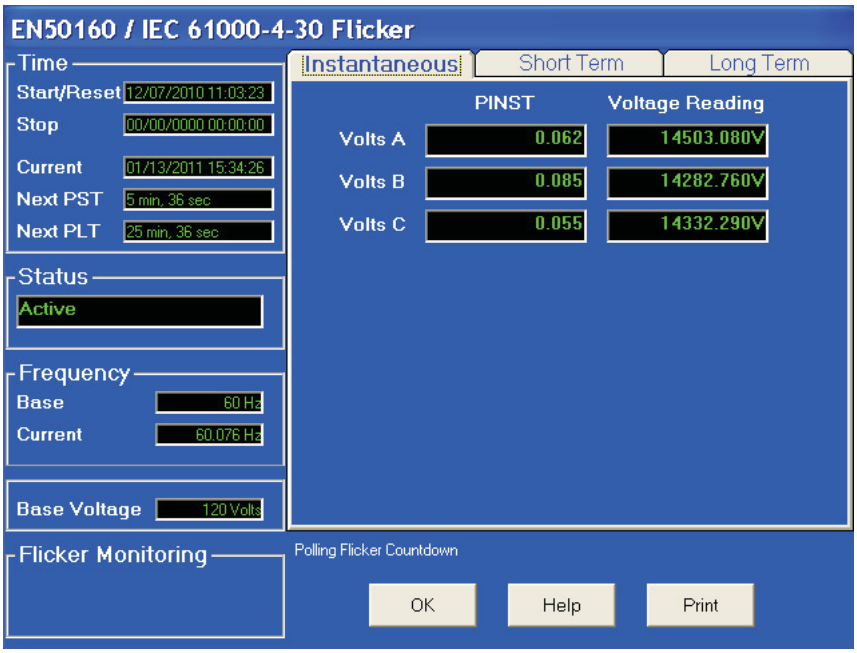
- Select a Short Term Test Time (PST) time range from 1 to 10 minutes. The standard measurement period is nominally 10 minutes.

- Select a Long Term Test Time (PLT) time range from 1 to 240 minutes. The standard measurement is nominally 12 Pst periods (120 minutes). Plt time must always be equal to or great than and a multiple of Pst time. This is reflected in the available selections.

3. Click **OK** when you are finished.

14.4: Flicker Polling Screen

1. From the Communicator EXT Title bar, select **Real-Time Poll>Power Quality and Alarms>Flicker**. You will see the screen shown below.



Main screen:

This section describes the Main Screen functions. These functions are found on the left side of the screen.

Time:

- Start/Reset is the time when Flicker was started or reset. A Reset of Flicker causes the Max/Min values to be cleared and restarts the Flicker Pst and Plt timers. A Start of Flicker is also equivalent to a Reset in that the PST and PLT are restarted and the Max/Min Values are cleared.
- Stop corresponds to the time when Flicker is turned off.
- Current is the current clock time.
- Next Pst is the countdown time to when the next Pst value is available.
- Next Plt is the countdown time to when the next Plt value is available.

Status:

- Indicates the current status: Active = On; Stopped = Off.

Frequency:

- Base is the operating frequency (50 or 60 Hz) selected in the EN50160 Flicker screen (see Section 14.3).
- Current is the real-time frequency measurement of the applied Voltage.

Base Voltage:

- The normalized Voltage for the selected frequency (230 V for 50 Hz or 120 V for 60 Hz).

Flicker Monitoring:

- Clicking on **Stop** causes Flicker to stop being processed and freezes all the current values. Stop Time is recorded and the current Max/Min values are cleared.
- Clicking on **Start** starts Flicker processing. Start Time is recorded.
- Clicking on **Reset** causes the Max/Min values to be cleared and restarts the Flicker Pst and Plt timers.

Use the tabs at the top of the screen to navigate to the Instantaneous, Short Term, and Long Term Readings views, shown on the right side of the screen.

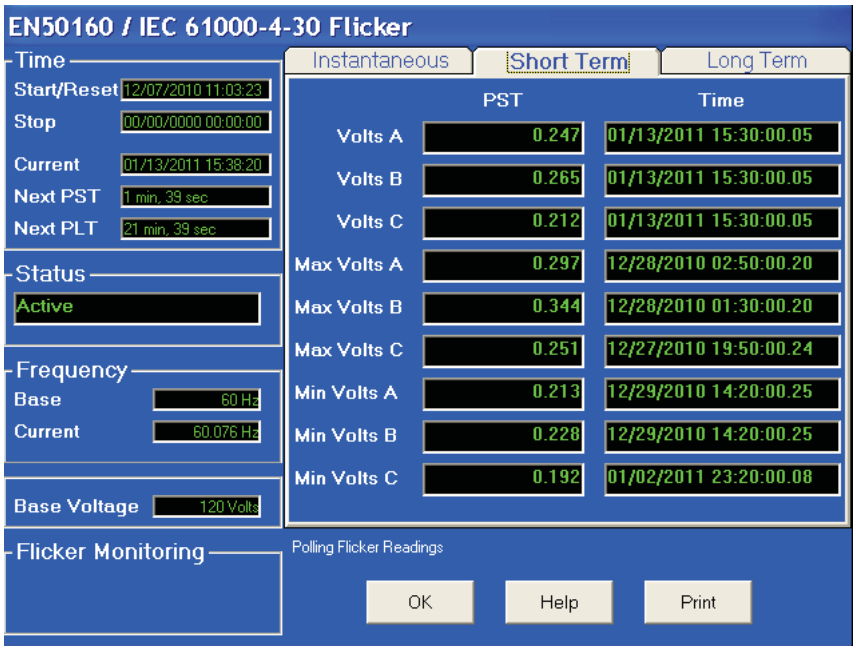
Instantaneous Readings:

NOTE: The Instantaneous view is the default of this screen. (See the screen pictured on the previous page.) If you are in the Short or Long Term views, click on the Instantaneous tab to display this view.

- The PU values, Pinst for Voltage Inputs Va, Vb and Vc are displayed here and are continuously updated. The corresponding Current Voltage values for each channel are displayed for reference.

Short Term Readings:

Click on the Short Term tab to access a screen containing three groups of Pst readings (shown below).



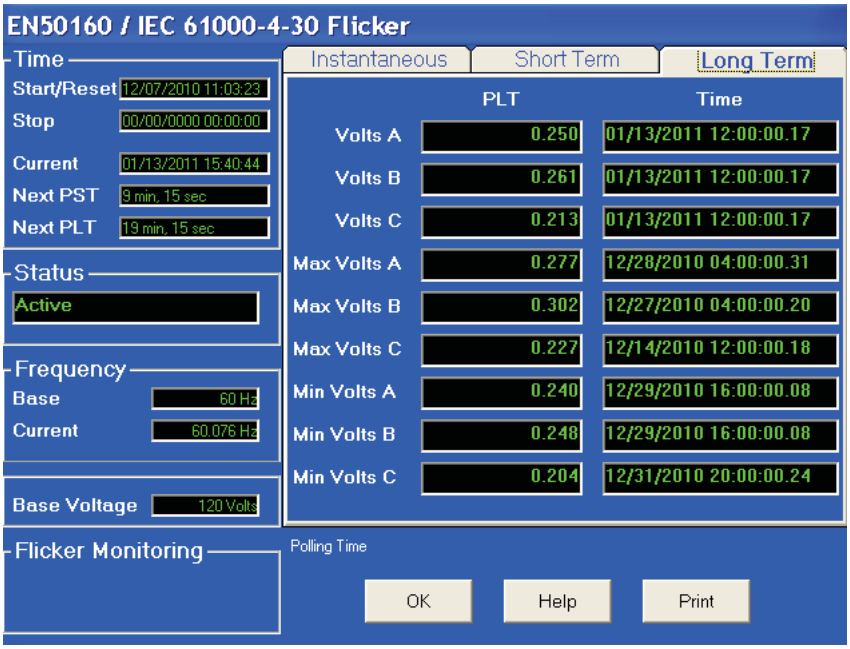
Pst Readings Displayed:

- Current Pst values for Va, Vb and Vc and the time of computation.
- Current Pst Max values for Va, Vb and Vc since the last reset and the time of the last reset.

- Current Pst Min values for Va, Vb and Vc since the last reset and the time of the last reset.

Long Term Readings:

1. Click on the Long Term tab to access a screen containing three groups of Plt readings (shown below).



Plt Readings Displayed:

- Current Plt values for Va, Vb and Vc and the time of computation.
- Current Plt Max values for Va, Vb and Vc since the last reset and the time of the last reset.
- Current Plt Min values for Va, Vb and Vc since the last reset and the time of the last reset.

2. Click **OK** to exit the EN50160/IEC61000-4-30 Flicker Polling screen; click **Print** to print all of the Readings views.

14.5: Logging

The Nexus® 1262/1272 meter is capable of logging Flicker values in an independent log. When Flicker is on, entries are made into the log in accordance with the times that associated values occur. Pst, Pst Max, Pst Min, Plt, Plt Max, Plt Min, Start/Reset and Stop times are all recorded. All values can be downloaded to the Log Viewer where they are available for graphing or export to another program, such as Excel. All Flicker values are pre-defined and cannot be changed. Refer to Chapter 8 of the *Communicator EXT User Manual* for additional instructions concerning the Flicker log.

14.6: Polling through a Communication Port

The Pinst, Pst, Pst Max, Pst Min, Plt, Plt Max, Plt Min values can be polled through the Communications Port. Refer to the Nexus® 1262/1272 meters' Modbus and DNP Mapping manuals for register assignments and data definitions.

14.7: Log Viewer

1. Open Log Viewer by selecting the **Open Logs** icon from Communicator EXT's Icon bar.

2. Using the menus at the top of the screen, select a meter, time ranges and values to access.

3.Click the **Flicker** icon.

The values and the associated time stamps (when the values occurred) are displayed in a grid box. Use the buttons at the bottom of the screen to create a graph or export the data to another program.

- Graphed values include Pst and Plt Va, Vb and Vc.

- Displayed values include Pst and Plt Max and Min for Va, Vb and Vc.

NOTE: Max and Min values are only displayed; they cannot be graphed. However, Max and Min values are available for export.

14.8: Performance Notes

Pst and Plt average time are synchronized to the clock (e.g. for a 10 minute average, the times will occur at 0, 10, 20, etc.). The actual time of the first average can be less than the selected period to allow for initial clock synchronization.

If the wrong frequency is chosen (e.g. 50Hz selection for a system operating at 60Hz), Flicker will still operate but the computed values will not be valid. Therefore, you should select the frequency setting with care.

User settings are stored. If Flicker is on and power is removed from the meter, Flicker will still be on when power returns. This can cause gaps in the logged data.

The Max and Min values are stored, and are not lost if the unit is powered down.

Flicker meets the requirements of IEC 61000-4-15 and former IEC 868. Refer to those specifications for more details, if needed. Meters with the Flicker option also meet the IEC61000-4-30 conformance standards for Flicker. Refer to chapters 16 and 17 in the *Communicator EXT User Manual* for additional information.

Operation is at 230V for 50Hz and 120V for 60Hz as per specification. If the input Voltage is different, the system will normalize it to 230V or 120V for computational purposes.

A: Transformer Line Loss Compensation Spreadsheet and Examples

A.1: Calculating Values

Transformer Loss Compensation is discussed in Chapter 8. Values for three element installations can be calculated in two ways:

Through an Excel Spreadsheet:

1. Click the **TLC Calculator** button on the Transformer Loss screen of the meter's Device Profile. The TLC Calculator button activates an Excel Spreadsheet, but ONLY if you have MS Excel installed on your computer. A copy of the Excel Spreadsheet is shown on the following pages with example numbers.

2. Enter the required data into the Excel Spreadsheet. The Excel program will calculate the values needed for the Transformer Loss screen of the Device Profile.

3. Enter the values into the Device Profile.

Manually:

1. Use the worksheet found in Chapter 8, "Three Element Loss Compensation Worksheet" to calculate the values by hand. Refer to the Notes under each section.

2. Enter values based on the transformer manufacturer's test report. The worksheet is progressive and notes under each section will guide you to the next section.

3. Enter the values into the Device Profile.

A.2: Excel Spreadsheet with Example Numbers

If you have MS Excel installed in your computer, use the **TLC Calculator** button on the Transformer Loss screen of the Device Profile. Refer to the spreadsheet copies with example numbers, found on the following pages.

IMPORTANT! Refer to Appendix B of the Communicator EXT User Manual for additional instructions and information on the Transformer Line Loss application.

Electro Industries / GaugeTech (877) EIMETER (877.346.3837)

1800 Shames Drive, Westbury, NY 11590

System Losses Summary

EIG Loss Compensation Calculator

Meter Correction Factors from this sheet are manually entered into EIG Communicator Software

Note: Begin Data Entry by Going to Xfmr Loss Sheet

Company:	Example 2 - EEI Handbook Example	Project	
Name:		Location	
Date:			

Comments: Example of Loss Calculation that includes Transformer Losses, but no Substation or Line Losses.

Meter Correction Factors for Communicator Software		Loss Factors Calc	Used	
% No-Load Loss Watts	%LWFE	2.16780	2.168	Enter These
% Full-Load Loss Watts	%LWCU	0.02471	0.025	Values in
% No-Load Loss VARs	%LVFE	58.45983	58.460	Communicator
% Full-Load Loss VARs	%LVCU	0.35639	0.356	Software

Losses Shifted to IT Primary		per element	Total	Unit
LWFE	Core-Loss Watts	78.04	234.12	kW
LVFE	Core-Loss VArs	2,104.55	6,313.65	kVAr
LWCU	Watts Loss due to Cu	0.89	2.67	kW
LVCU	VA Rated Loss due to Cu	12.83	38.49	kVAr
VAnom	Nominal Meter VA Rating		10,800.00	kVA

Total System Losses

total losses *Note: If no data entered in Line or Substation Loss sheets contribution to total is zero*

Type	Source		kWatts Loss		kVAr Losses
No-Load Losses	Transformer Core	NLW	28.68	NLV	94.74
Load Losses	Transformer Windings	FLW	56.03	FLV	807.98
	Transmission Line	LLW	0.00	LLV	0.00
	Substation Conductors	CLW	0.00	CLV	0.00
	Total Load Losses	TLW	56.03	TLV	807.98

per element losses

Type	Source		kWatts Loss		kVAr Losses
No-Load Losses	Transformer Core	NLW	9.56	NLV	31.58
Load Losses	Transformer Windings	FLW	18.68	FLV	269.33
	Transmission Line	LLW	0.00	LLV	0.00
	Substation Conductors	CLW	0.00	CLV	0.00
	Total Load Losses	TLW	18.68	TLV	269.33

Comments:

Legend

- Information Only
- Required Data
- Calculated Value
- Data from other Sheet
- Enter this Data
- Comments

Publishing and duplicating rights are property of Electro Industries/GaugeTech. This spreadsheet is designed only to be used with EIG Nexus based metering equipment.

Electro Industries / GaugeTech

1800 Shames Drive, Westbury, NY 11590 **(877) EIMETER [877-346-3837]**

Transformer Losses — EIG Loss Compensation Calculator

Company:	Example 2 - EEI Handbook	Substation:	
Name:		Xmfr Bank No.:	
Date:		Xmfr S/N:	
Xmfr Manf:		Company Number	

Winding		
HV - High		
XV - Low		
YV - Tert.		

Comments:

Legend
- Information Only
- Required Data
- Calculated Value
- Data from other Sheet
- Enter this Data
- Comments

Transformer Losses		Losses per Element	Losses Total	Unit
No Load VA	NLVA	32.9967	98.9901	kVA
No Load Watts	NLW	9.5600	28.6800	kW
No-Load Loss VARs	NLV	31.5815	94.7444	kVAr
Full Load VA	FLVA	269.9730	809.9190	kVA
Full-Load Loss Watts	FLW	18.6757	56.0270	kW
Full-Load Loss VARs	FLV	269.3263	807.9788	kVAr

Power Transformer Data		Watts Loss Total	per element	Calculated	kVA
Value					
No Load Loss Watts	LWFe	28,680.00		9,560.00	9.56
Full Load Loss Watts	LWCu	56,027.00		18,675.67	18.68
% Exciting Current	%Ix	0.99			
% Impedance	%Z	8.1			
Transformer kVA Rating	kVA Rated	9,999.00		3,333.00	
Rated Primary L_L Volts	Vp	115,000			

Power Transformer - 3 Transformer bank		Line-to-Line		Line-to-Neut.
V Secondary Side of Xmfr	Vs	2520	Vr	1455
Rated Transformer Current	I Rated	2291		
Wye or Delta Connection		Wye		

Meter / Installation Data	*Three Element Meter with 3 PT's and 3 CT's*		
Instrument Transformers	Primary	Secondary	Multiplier
Voltage Xmfr	7200	120	60
Current Xmfr	500	5	100
Transformer Factor	TF	6000	
Meter Voltage Rating	VM	120	120 volts for Nexus
Meter Test Amps	TA	2.5	2.5 amps for Nexus
Meter Class	CL	20	Nexus CL20
Meter Form	Fm		
Nominal Current	Inom	2.5	Typically .5 Class(10) or TA(2.5)

Publishing and duplicating rights are property of Electro Industries/GaugeTech.
This spreadsheet is designed only to be used with EIG Nexus based metering equipment.

Electro Industries / GaugeTech

1800 Shames Drive, Westbury, NY 11590 (877) EIMETER [877-346-3837]

Line Losses

EIG Loss Compensation Calculator

Three Element Meter with 3 PT's and 3 CT's

Note: Leave Data Entry Cells Blank if not including Line Losses

Company:	Example 2 - EEI Handbook	Substation:	
Name:		Stn Trf Bank No.:	
Date:			

Metering Point Information	

Line Losses		Losses		
Value		per phase	Total	Unit
Total Line Length			0.0000	Mile
Line Current	Ip		50.1994	Amp
Line Loss Watts	LLW	0.0000	0.0000	kW
Line Loss VArs	LLV	0.0000	0.0000	kVA

Transmission Line Impedance Data				
Value		per Unit	Total	Unit
Resistance	R/unit	0.0000		Ohms
Inductive Reactance	XL/unit	0.0000		Ohms
Length of Line	LL - Units	0.0000		
Length Unit	U	Mile		
Resistive Losses			0.0000	kW
Inductive Losses			0.0000	kars

Note: Please make sure data entered uses a consistent unit of length

Adjustment for Line Charging Current				
Value		per Unit	Total	Unit
Capacitive Reactance	XC-unit	0.0000	#REF!	Ohms
Charging Current per line	Amps		0.0000	Amps
Capacitive Losses	kvar		0.0000	kvars

Line Losses refected to Secondary of PT		Losses		
Value		per phase	Total	Unit
Nominal Pri kVA Rating	VA mom-pri		5.4783	kVA
Nominal Sec kVA Rating	VA mom-sec		5.4783	kVA
Line Loss Watts	LLW	#REF!	#REF!	kW
Line Loss VArs	LLV	0.0000	0.0000	kVA

Transformer Data from Xmfr Loss Sheet				
Value		per phase	Total	Unit
Transformer kVA Rating	kvars	3333.0000	9,999.00	kvars
Rated Primary L_L Volts	Vp		115,000.00	Volts

Note: This Data must be entered on Transformer Loss Sheet before completing Line Loss Calculation

Notes:

Legend

- Information Only
- Required Data
- Calculated Value
- Data from other Sheet
- Enter this Data
- Comments

Publishing and duplicating rights are property of Electro Industries/GaugeTech.

This spreadsheet is designed only to be used with EIG Nexus based metering equipment.

Electro Industries / GaugeTech

1800 Shames Drive, Westbury, NY 11590 **(877) EIMETER [877-346-3837]**

Substation Losses

EIG Loss Compensation Calculator

Three Element Meter with 3 PT's and 3 CT's

Note: Leave Data Entry Cells Blank if not including Line Losses

Company:	Example 2 - EEI Handbook	Substation:	
Name:		Stn Trf Bank No.:	
Date:			

Substation Information	Example of Loss Calculation that includes Transformer, Substation, and Li
	Line Losses.

Line Losses		Losses		
		Total	per Element	Unit
Total Conductor Length		0.00		FT
Secondary Current @ Rating	Ir	2290.843		Amp
Conductor Loss Watts	CLW	0.000	0.000	kW
Conductor Loss VArs	CLV	0.000	0.000	kVA

Transmission Line Impedance Data		
Value		per Unit
Resistance		0.000000
Inductive Reactance	x	0.000000
Length of Conductor	CL	0.00
Length Unit	U	FT

Legend

Information Only	
Required Data	
Calculated Value	
Data from other Sheet	
Enter this Data	
Comments	

Note: This Data must be entered on Transformer Loss Sheet before completing Substation Loss Calculation

Transformer Data from Xmfr Loss Sheet			
Value			
Transformer kVA Rating	kVAr	9,999	3333.0000
Rated Secondary L_N Volts	Vr	1,455	

Publishing and duplicating rights are property of Electro Industries/GaugeTech.
This spreadsheet is designed only to be used with EIG Nexus based metering equipment.

This page intentionally left blank.

B: Blade Configuration for Forms 9S, 36S and 45S

B.1: 1262/1272 Forms

Four supported forms for the Nexus® 1262/1272 Socket meters with their wiring configurations are shown in Chapter 11. Those forms are based on the rated Voltage and hookup required for your application. (Custom forms and configurations are also available from EIG.)

The three supported forms with wiring configurations for the Nexus® 1262/1272 Socket meters are listed below:

9S

- Wye, no PTs or 3 PTs, 3CTs
- 3-Wire Delta, no PTs or 2 PTs, 2 CTs
- 2.5EL Wye, no PTs or 2 PTs, 3 CTs
- 4-Wire Delta, no PTs or 2 PTs, 2 CTs
- 4-Wire Delta, no PTs or 3 PTs, 3 CTs

36S

- 2.5EL Wye, no PTs or 2 PTs, 3 CTs

45S

- Wye, no PTs or 2 PTs, 3 CTs
- 3-Wire Delta, no PTs or 2 PTs, 2 CTs
- 4-Wire Delta, no PTs or 2 PTs, 2 CTs

B.2: Blade Configuration Drawings

Detailed drawings of the Blade configurations are offered below. There are two configurations because the 9S and the 36S are the same. There is a drawing showing the knockout holes for each configuration.

NOTE: The forms referred to in this appendix comply with ANSI forms 9S, 36S and 45S.

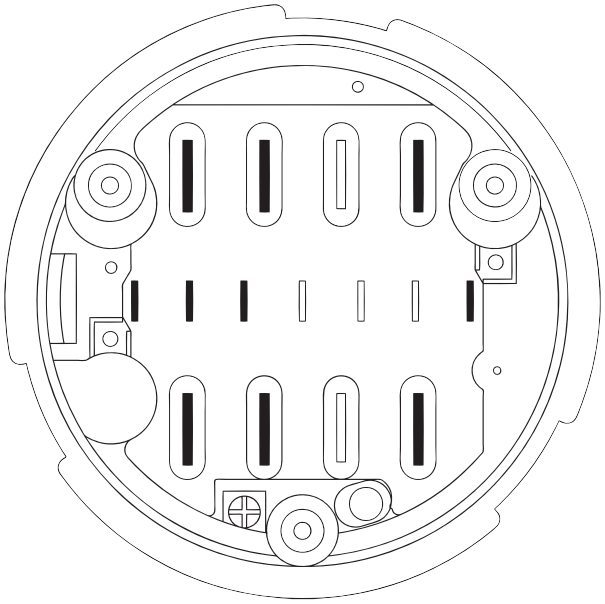


Figure B.1: Form 9S & 36S Base with Knock Out Holes

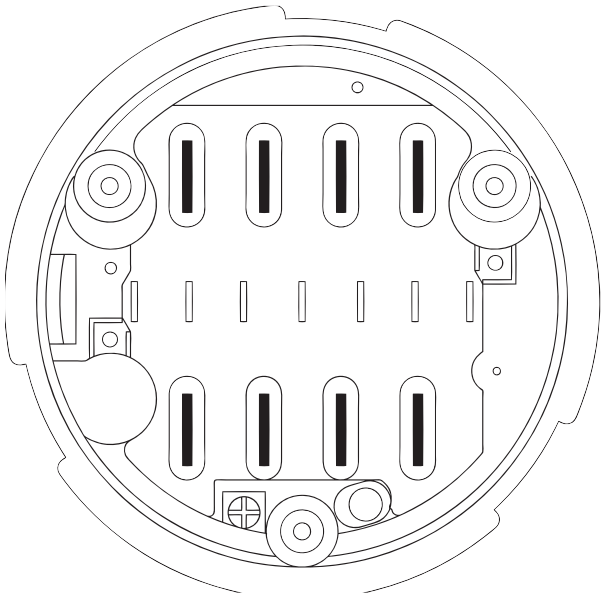


Figure B.2: Form 45S Base with Knock Out Holes

Glossary

0.2 Second Values:	These values are the RMS values of the indicated quantity as calculated after approximately 200 milliseconds (3 cycles) of sampling.
1 Second Values:	These values are the RMS values of the indicated quantity as calculated after one second (60 cycles) of sampling.
Alarm:	An event or condition in a meter that can cause a trigger or call-back to occur.
Annunciator:	A short label that identifies particular quantities or values displayed, for example kWh.
Average (Current):	When applied to current values (Amps) the average is a calculated value that corresponds to the thermal average over a specified time interval. The interval is specified by the user in the meter profile. The interval is typically 15 minutes. So, Average Amps is the thermal average of Amps over the previous 15-minute interval. The thermal average rises to 90% of the actual value in each time interval. For example, if a constant 100Amp load is applied, the thermal average will indicate 90 amps after one time interval, 99 amps after two time intervals and 99.9 amps after three time intervals.
Average (Input Pulse Accumulations:	When applied to Input Pulse Accumulations, the "Average" refers to the block (fixed) window average value of the input pulses.

Average (Power):	When applied to power values (Watts, VARs, VA), the average is a calculated value that corresponds to the thermal average over a specified time interval. The interval is specified by the user in the meter profile. The interval is typically 15 minutes. So, the Average Watts is the thermal average of Watts over the previous 15-minute interval. The thermal average rises to 90% of the actual value in each time interval. For example, if a constant 100kW load is applied, the thermal average will indicate 90kW after one time interval, 99kW after two time intervals and 99.9kW after three time intervals.
Bit:	A unit of computer information equivalent to the result of a choice between two alternatives (Yes/No, On/Off, for example). Or, the physical representation of a bit by an electrical pulse whose presence or absence indicates data.
Binary:	Relating to a system of numbers having 2 as its base (digits 0 and 1).
Block Window Avg (Power):	The Block (Fixed) Window Average is the average power calculated over a user-set time interval, typically 15 minutes. This calculated average corresponds to the demand calculations performed by most electric utilities in monitoring user power demand. (See Rolling Window Average.)

Byte:	A group of 8 binary digits processed as a unit by a computer (or device) and used especially to represent an alphanumeric character.
CBEMA Curve:	A Voltage quality curve established originally by the Computer Business Equipment Manufacturers Association. The CBEMA Curve defines Voltage disturbances that could cause malfunction or damage in microprocessor devices. The curve is characterized by Voltage magnitude and the duration which the Voltage is outside of tolerance. (See ITIC Curve.)
Channel:	The storage of a single value in each interval in a load profile.
Cold Load Pickup	This value is the delay from the time control power is restored to the time when the user wants to resume demand accumulation.
CRC Field:	Cyclic Redundancy Check Field (Modbus communication) is an error checksum calculation that enables a Slave device to determine if a request packet from a Master device has been corrupted during transmission. If the calculated value does not match the value in the request packet, the Slave ignores the request.
CT (Current) Ratio:	A Current Transformer Ratio is used to scale the value of the current from a secondary value up to the primary side of an instrument transformer.
Cumulative Demand:	The sum of the previous billing period maximum demand readings at the time of billing period reset. The maximum demand for the most recent billing period is added to the previously

	accumulated total of the maximum demands.
Demand:	The average value of power or a similar quantity over a specified period of time.
Demand Interval:	A specified time over which demand is calculated.
Display:	User-configurable visual indication of data in a meter.
DNP 3.0:	A robust, non-proprietary protocol based on existing open standards. DNP 3.0 is used to operate between various systems in electric and other utility industries and SCADA networks.
EEPROM:	Nonvolatile memory; Electrically Erasable Programmable Read Only Memory that retains its data during a power outage without need for a battery. Also refers to meter's FLASH memory.
Energy Register:	Programmable record that monitors any energy quantity. Example: Watt-hours, VAR-hours, VA-hours.
Ethernet:	A type of LAN network connection that connects two or more devices on a common communications backbone. An Ethernet LAN consists of at least one hub device (the network backbone) with multiple devices connected to it in a star configuration. The most common versions of Ethernet in use are 10BaseT and 100BaseT as defined in IEEE 802.3 standards. However, several other versions of Ethernet are also available.
Flicker:	Flicker is the sensation that is experienced by the human visual system when it is subjected to

	changes occurring in the illumination intensity of light sources. IEC 61000-4-15 and former IEC 868 describe the methods used to determine Flicker severity.
Harmonics:	Measuring values of the fundamental current and Voltage and percent of the fundamental.
Heartbeat Pulse:	Energy indicator on the face of the Nexus® 1250/ 1252 meter; pulses are generated per the programmed Ke value.
I2T Threshold:	Data will not accumulate until current reaches programmed level.
Integer:	Any of the natural numbers, the negatives of those numbers, or zero.
Internal Modem:	An optional modem within the meter's enclosure that connects to the RJ11 telephone connector.
Invalid Register:	In the Nexus® meter's Modbus Map there are gaps between Registers. For example, the next Register after 08320 is 34817. Any unmapped Register stores no information and is said to be invalid.
ITIC Curve:	An updated version of the CBEMA Curve that reflects further study into the performance of microprocessor devices. The curve consists of a series of steps but still defines combinations of Voltage magnitude and duration that will cause malfunction or damage.
Ke:	kWh per pulse; i.e. the energy.

kWh:	Kilowatt hours; kW x demand interval in hours.
KYZ Output:	Output where the rate of changes between 1 and 0 reflects the magnitude of a metered quantity.
LCD:	Liquid Crystal Display.
LED:	Light Emitting Diode.
Maximum Demand:	The largest demand calculated during any interval over a billing period.
Modbus ASCII:	Alternate version of the Modbus protocol that utilizes a different data transfer format. This version is not dependent upon strict timing, as is the RTU version. This is the best choice for telecommunications applications (via modems).
Modbus RTU:	The most common form of Modbus protocol. Modbus RTU is an open protocol spoken by many field devices to enable devices from multiple vendors to communicate in a common language. Data is transmitted in a timed binary format, providing increased throughput and therefore, increased performance.
Network:	A communications connection between two or more devices to enable those devices to send to and receive data from one another. In most applications, the network is either a serial type or a LAN type.
NVRAM:	Nonvolatile Random Access Memory: able to keep the stored values in memory even during the loss of circuit or control power. High speed NVRAM is used in the Nexus® meter to gather

	measured information and to insure that no information is lost.
Optical Port:	A port that facilitates infrared communication with a meter. Using an ANSI C12.13 Type II magnetic optical communications coupler and an RS232 cable from the coupler to a PC, the meter can be programmed with Communicator EXT software.
Packet:	A short fixed-length section of data that is transmitted as a unit. Example: a serial string of 8-bit bytes.
Percent (%) THD:	Percent Total Harmonic Distortion. (See THD.)
Protocol:	A language that is spoken between two or more devices connected on a network.
PT Ratio:	Potential Transformer Ratio used to scale the value of the Voltage to the primary side of an instrument transformer. Also referred to as VT Ratio.
Pulse:	The closing and opening of the circuit of a two-wire pulse system or the alternate closing and opening of one side and then the other of a three-wire system (which is equal to two pulses).
Q Readings:	Q is the quantity obtained by lagging the applied Voltage to a wattmeter by 60 degrees. Values are displayed on the Uncompensated Power and Q Readings screen.

Quadrant (Programmable Values and Factors on the Nexus® meter:)	Watt and VAR flow is typically represented using an X-Y coordinate system. The four corners of the X-Y plane are referred to as quadrants. Most power applications label the right hand corner as the first quadrant and number the remaining quadrants in a counter-clockwise rotation. Following are the positions of the quadrants: 1st - upper right, 2nd - upper left, 3rd - lower left and 4th - lower right. Power flow is generally positive in quadrants 1 and 4. VAR flow is positive in quadrants 1 and 2. The most common load conditions are: Quadrant 1 - power flow positive, VAR flow positive, inductive load, lagging or positive power factor; Quadrant 2 - power flow negative, VAR flow positive, capacitive load, leading or negative power factor.
Register:	An entry or record that stores a small amount of data.
Register Rollover:	A point at which a Register reaches its maximum value and rolls over to zero.
Reset:	Logs are cleared or new (or default) values are sent to counters or timers.
Rolling Window Average (Power):	The Rolling (Sliding) Window Average is the average power calculated over a user-set time interval that is derived from a specified number of sub-intervals, each of a specified time. For

example, the average is calculated over a 15-minute interval by calculating the sum of the average of three consecutive 5-minute intervals. This demand calculation methodology has been adopted by several utilities to prevent customer manipulation of kW demand by simply spreading peak demand across two intervals.

RS232: A type of serial network connection that connects two devices to enable communication between the devices. An RS232 connection connects only two points. Distance between devices is typically limited to fairly short runs.
Current standards recommend a maximum of 50 feet but some users have had success with runs up to 100 feet.
Communications speed is typically in the range of 1200 bits per second to 57,600 bits per second.
RS232 connection can be accomplished using Port 1 of the Nexus® 1250/1252 meter.

RS485: A type of serial network connection that connects two or more devices to enable communication between the devices. An RS485 connection allows multi-drop communication from one to many points.
Distance between devices is typically limited to around 2,000 to 3,000 wire feet.
Communications speed is typically in the range of 120 bits per second to 115,000 bits per second.

Sag: A Voltage quality event during which the RMS Voltage is lower than normal for a period of time, typically from 1/2 cycle to 1 minute.

Secondary Rated: Any Register or pulse output that does not use any CT or PT(VT) Ratio.

Serial Port: The type of port used to directly interface with a device using the RS232 standard.

Swell: A Voltage quality event during which the RMS Voltage is higher than normal for a period of time, typically from 1/2 cycle to 1 minute.

TDD: The Total Demand Distortion of the current waveform. The ratio of the root-sum-square value of the harmonic current to the maximum demand load current. (See equation below.)
NOTE: The TDD displayed in the Harmonics screen is calculated by Communicator EXT software, using the Max Average Demand.

$$1TDD = \sqrt{\frac{I_2^2 + I_3^2 + I_4^2 + I_5^2 + ...x100\%}{I_L}}$$

THD: Total Harmonic Distortion is the combined effect of all harmonics measured in a Voltage or current. The THD number is expressed as a percent of the fundamental. For example, a 3% THD indicates that the magnitude of all harmonic distortion measured equals 3% of the magnitude of the fundamental 60Hz quantity. The %THD displayed is calculated by your Nexus® meter.

Time Stamp: A stored representation of the time of an event. Time Stamp can include year, month, day, hour, minute, second and Daylight Savings Time indication.

TOU:	Time of Use.
Uncompensated Power:	VA, Watt and VAR readings not adjusted by Transformer Loss Compensation.
V2T Threshold:	Data will stop accumulating when Voltage falls below programmed level.
Voltage Imbalance:	The ratio of the Voltage on a phase to the average Voltage on all phases.
Voltage Quality Event:	An instance of abnormal Voltage on a phase. The events the meter tracks include sags, swells, interruptions and imbalances.
VT Ratio:	The Voltage Transformer Ratio is used to scale the value of the Voltage to the primary side of an instrument transformer. Also referred to as PT Ratio.
Voltage, Vab:	Vab, Vbc, Vca are all Phase-to-Phase Voltage measurements. These Voltages are measured between the three phase Voltage inputs to the meter.
Voltage, Van:	Van, Vbn, Vcn are all Phase-to-Neutral Voltages applied to the monitor. These Voltages are measured between the phase Voltage inputs and Vn input to the meter. Technologically, these Voltages can be "measured" even when the meter is in a Delta configuration and there is no connection to the Vn input. However, in this configuration, these Voltages have limited meaning and are typically not reported.

Voltage, Vaux	This is the fourth Voltage input measured from between the Vaux and Vref inputs. This input can be scaled to any value. However, the actual input Voltage to the meter should be of the same magnitude as the Voltages applied to the Va, Vb and Vc terminals.